



Milwaukie Community Climate Action Plan

DRAFT – 8/21/2018

Dear CAPC members:

Thank you for reviewing the draft Climate Action Plan!

For your convenience and to help aggregate all feedback, we've developed an [online comment form](#) for you to provide suggestions and edits. **Please submit all feedback by midnight on Sunday, August 26.**

Please note the following steps will be taken after your review of the document:

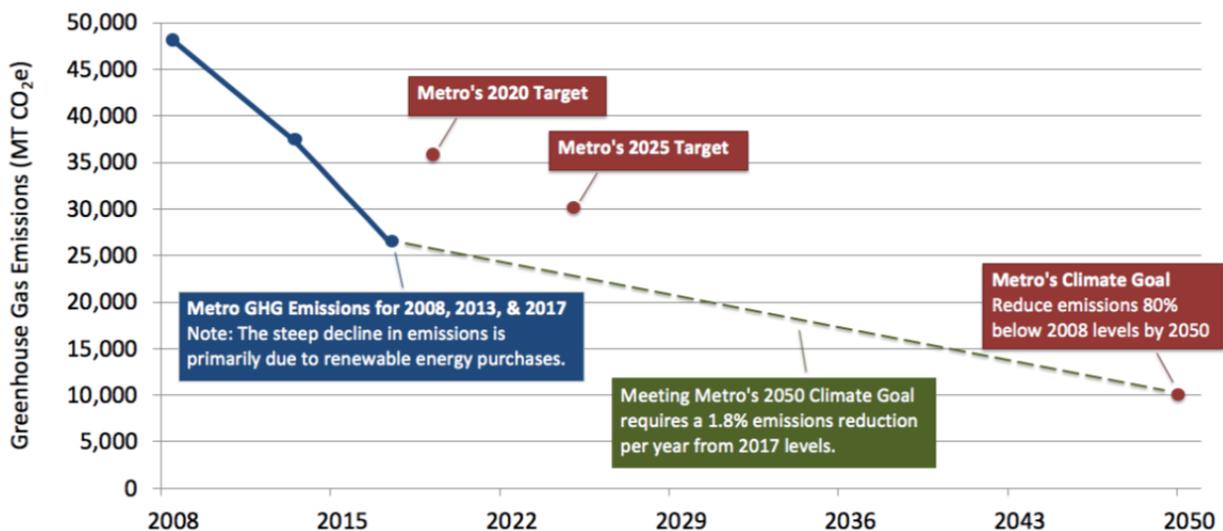
Layout and document format:

- The project team will format the document in a professional layout using InDesign. The final layout will include more photos, graphics and elements to make the Plan visually engaging and easy to read. Several charts will be remade in the final layout to create a cohesive visual style.
- The Plan can stand alone as a single document, but it will also be packaged specifically for three audience groups (each version of the plan will include the same introductory material and audience-specific actions lists within the topic chapters):
 - City staff and partners
 - Businesses and community organizations
 - Milwaukie residents and households
- The Mayor's introductory letter will be inserted in the final version.
- A table of Figures and reference list will be added in the final version.

Emissions reduction tables:

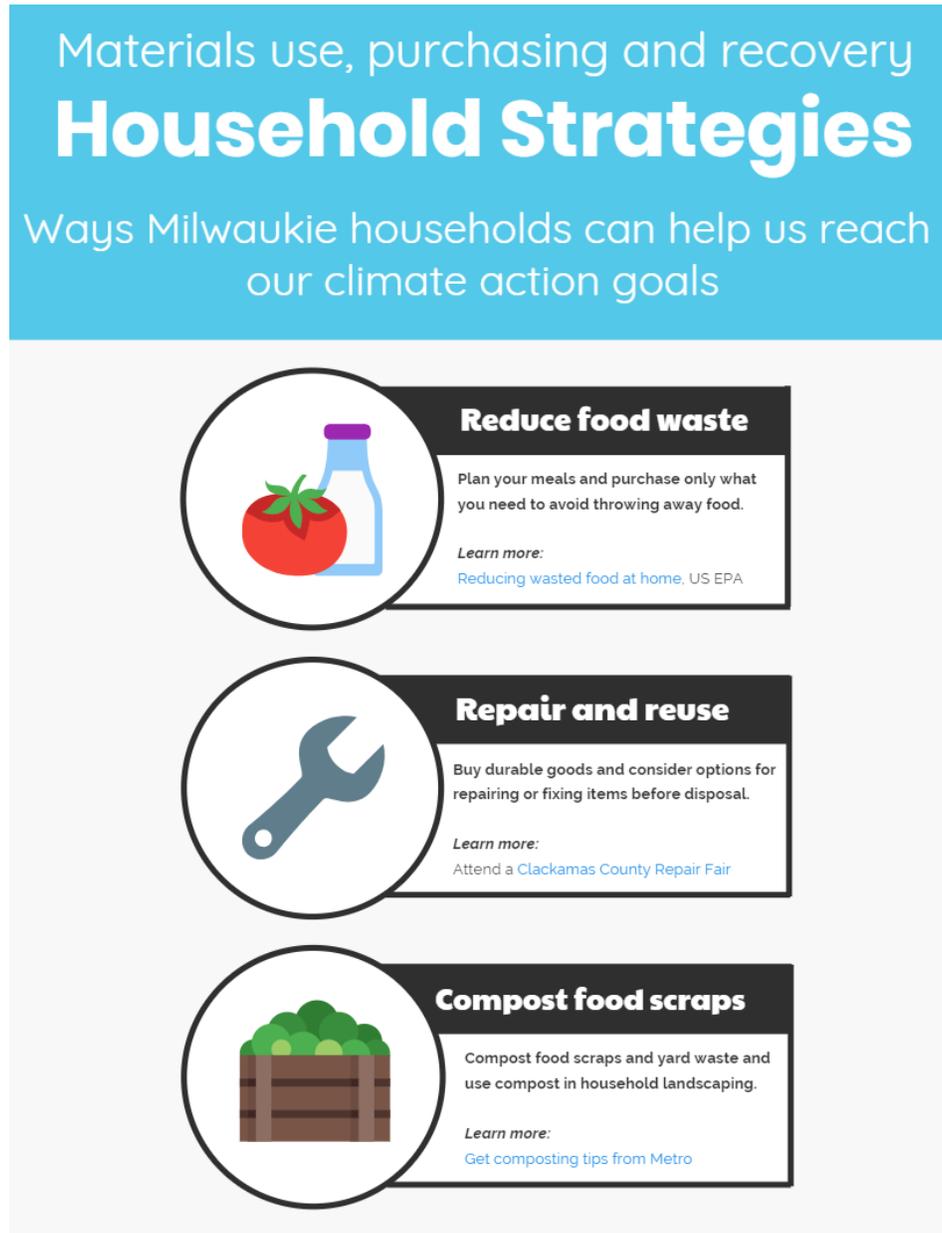
- To improve readability, the project team will format the current "emissions reductions over time tables" as graphs like the example below:

Figure ES-1: Metro's progress toward climate goal (excluding supply chain emissions)



Household and organizational strategies:

- Household and organizational strategies will be presented as an infographic similar to this in the final document:



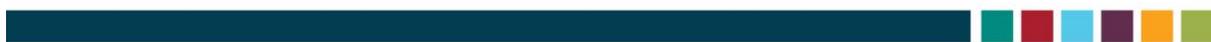
We appreciate your participation in this process and invaluable contributions to this plan. Thank you for taking the time to review and provide your thoughts.

Sincerely,
The project team



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Mayor's letter

In progress...



1. Introduction

Why do we need a Climate Action Plan?

We—the Milwaukie community—have an opportunity to act on climate change. Our rapidly changing climate and rising global temperatures impact our city and the entire planet. We’re already witnessing more extreme weather and climate events in our region. Acting together early ensures that we are more empowered and prepared to preserve our health and quality of life for current and future generations.

Milwaukie’s Climate Action Plan is our community’s road map to mitigating and adapting to the effects of climate change. Implementing this plan is a powerful, crucial step in preserving our future. Co-created by community members and partners, the plan includes opportunities for people who live and work in Milwaukie to join together and address this challenge. The Climate Action Plan was developed using the best science and the best of our community’s thinking, and it is “custom made” for Milwaukie, reflecting community priorities and values.

Our Climate Action Plan will help us:

- Guide our efforts to reduce our community emissions
- Plan infrastructure and land use projects
- Prioritize City actions and initiatives
- Advocate for coordinated change with our community partners
- Educate our community about the impact of our habits
- Promote sustainable economic development

Each of us is a vital part of the community. Everyone has a role to play. Taking on this challenge allows us to create a stronger local economy, take care of those that might be struggling and create a place that is more comfortable in which to live. When we each make a change, that benefits us all.

Building on a strong foundation

Milwaukie City Council has declared climate action a key Council goal. In 2018, City Council directed additional resources towards achieving climate-related items called out in Milwaukie’s community Vision Action Plan and this Climate Action Plan. This work will require a dedicated staff person and the development of metrics to track progress—both of which are funded in the 2018 City budget.

Before adopting this Climate Action Plan, the City had already taken significant strides toward reducing local emissions and preparing our community for climate change. The following list reflects some of the foundational actions taken by the City of Milwaukie that this Climate Action Plan builds upon (for more information, see Appendix C):

Building Energy and Efficiency

- Purchase of 76.7% of the City's electricity through PGE's Clean Wind Tariff.
- Adoption of plans to retrofit the City's Ledding Library to use 1/6 of its former energy consumption.
- Enrollment in the Energy Trust's Strategic Energy Management (SEM) Program, which teaches businesses and governments how to integrate energy management practices into their operations.
- Partnership with Ameresco to fund a contract to replace HVAC controls and lighting in City facilities with more efficient systems.
- Solar workshops to educate local property owners and connect them with solar installers.

Vehicle Fleets and Fuels

- Purchase of three electric vehicles to replace City administrative cars.
- Installation of a public electric vehicle charging station and a fleet charging station.
- Partnership with Portland General Electric to plan an "Electric Avenue" charging station at the intersection of Jackson and McLoughlin Blvd.

Land Use and Transportation Planning

- Implementation of a green building energy height bonus, leading to greener new construction in the downtown area.
- Commitment of \$21 million to the Safe Access for Everyone (SAFE) program to improve safety and access throughout the city, including constructing 27.9 miles sidewalks four miles of bike lanes and 900 ADA ramps between 2019 and 2021.

Natural Resources

- Creation of a community Tree Board and commitment to increasing our tree canopy from 26% to 40% by 2035.

Planning process

City leadership hired a professional consulting team to guide the climate action planning process, convening people who live and work in Milwaukie as well as key implementation partners. The planning process included the following key steps:

1. **Community carbon footprint:** The project team developed a current and project future community carbon footprint for Milwaukie, considering population growth and the impact of existing policies over time.
2. **Future physical conditions:** The project team researched what the future physical conditions in Milwaukie could be under different climate change scenarios.
3. **Climate Action Plan Committee (CAPC):** The City chartered a committee composed of residents and key partners to advise the project team throughout the process.
4. **Implementation partner workshops:** The project team conducted six workshops with major organizational and agency partners in spring 2018 to determine priority strategies.

5. **Public engagement:** The project team conducted two community events and an online survey to gather broader public feedback on prioritized strategies.
6. **Scaling greenhouse gas reductions:** The project team modeled the projected reduction of greenhouse gases over time of each prioritized City-level mitigation strategy.
7. **Co-benefits analysis:** The project team analyzed the potential of each City-level strategy to deliver additional benefits beyond emissions reductions.
8. **Strategy development:** With the guidance of the CAPC, the project team developed an implementation timeline for City-level mitigation and adaptation strategies and prepared the Climate Action Plan.

Public engagement

Public engagement and feedback were essential to developing a compelling, realistic and implementable Climate Action Plan. As part of the planning process, the City led a robust community engagement effort to hear from as many residents and stakeholders as possible.¹

What we learned: Our community wants to see urgent action!

Over two hundred community members engaged in the climate action planning process. Key takeaways from this engagement include:

- Most participants at the spring Climate Action Summit think climate action is needed urgently. Our community is already experiencing the impacts of climate change—we need to make a change quickly.
- Milwaukians want to be a leader and pioneer in this space, inspiring other communities to follow suit.
- Community members have ideas for translating strategies into meaningful action. They want to be a part of this community-wide effort.
- People who live and work in Milwaukie need support to make these changes part of their daily routine. This support includes:
 - Education and awareness-raising
 - Accessible, easy to understand implementation resources
 - Demonstration projects and modeled behavior
 - Cost assistance
 - Community projects to make buy-in and implementation easier
 - Support groups, networks and trusted liaisons



Photo credit: Hamid Shibata Bennett



¹ A summary of public feedback collected through the planning process is available online at <https://bit.ly/2vIHRNI>

Climate Action Plan Committee

In January 2018, the City appointed the CAPC to advise staff throughout the planning process, represent community interests and help inform the community about the effort. Committee members helped shape the community engagement strategy and provided feedback on proposed actions and goals. The CAPC was comprised of 17 members: nine seats were filled by community members who applied at-large, and six seats were reserved for appointed members from leadership levels of key interest groups identified by the City. In addition, two City Council liaisons sit on the committee.

Implementation partner workshops

The project team engaged stakeholders through six implementation partner workshops in February and March 2018. At these workshops, technical and program leaders from implementation partner organizations provided feedback on proposed mitigation and adaptation strategies, identified local priorities and clarified what they can help deliver.²

Spanish language focus group

On April 2, 2018, project staff, in partnership with Ready Set Go, a program of Metropolitan Family Services, facilitated a focus group discussion with 14 Spanish speaking community members at Milwaukie City Hall. Hispanic/Latino(a) community members make up a significant proportion of the city's population, and this community is expected to grow. The discussion covered topics related to Milwaukie's Climate Action Plan and Comprehensive Plan Update processes. The focus group provided a chance for a focused conversation in Spanish prior to community-wide town hall-style events in recognition of the significant barriers faced by non-English speaking community members that limit and/or prohibit their participation in traditional engagement activities.

Climate Action Fair and Summit

On May 31, 2018, the City hosted a Climate Action Fair and Summit at the Waldorf School. The event began with an hour-long Climate Action Fair featuring 12 informational booths hosted by sustainability, resiliency and climate change-related organizations. The Summit program included educational presentations by Mayor Mark Gamba and members of the project team, followed by small group discussions on the six Climate Action Plan chapter topics.

Online community survey

Between May 31 and June 14, 2018, community members also had the opportunity to submit feedback on draft strategies via an online community survey. Within each chapter topic section, respondents could provide feedback about community-level and household-level strategies.

² Summaries of the implementation partner workshops are available online at <https://www.milwaukieoregon.gov/sustainability/climate-action-plan>.

Community engagement – by the numbers

Number	Activity
17	CAPC members
51	Implementation partner workshop attendees
14	Spanish language focus group attendees
75	Climate Action Fair and Summit attendees
101	Valid survey responses

Equity and climate action

Milwaukie’s “All Aboard” Community Vision declares that we are an inclusive, diverse community that honors our differences and shared similarities; provides opportunities for all; and makes all residents feel empowered to engage and share ideas. These goals apply directly to climate action. To make real progress on climate, all Milwaukie community members must see themselves in this community strategy and have access to the resources they need.

The City pursued an equitable engagement strategy to involve as many voices as possible in the climate action planning process. Specific activities included:

- Development of a comprehensive community engagement plan, including a community demographic analysis and identification of key interests and stakeholder groups to invite to workshops and other events
- Translation of the project fact sheet, comment form, and online community survey into Spanish
- A focus group with Spanish-speaking community members in conjunction with Maria Perdomo, Ready, Set, Go program coordinator and trusted community liaison
- Provision of childcare and food at the community Climate Action Summit to encourage family participation
- Simultaneous Spanish translation at the Climate Action Summit
- Direct outreach to community youth leaders
- Different types of engagement tools to allow for people to participate on their own time
- Engaging community members of all income levels to identify household strategies for all Milwaukians

Equity is woven through this Climate Action Plan in the following ways:

- City staff and the consulting team assessed each climate action strategy according to its potential to reduce disparities within the community. The results of this equity co-benefit scoring are summarized in the topic-specific chapters.
- Household-level strategies and associated resources are identified in each chapter to make climate action accessible for all Milwaukians.

- The plan also acknowledges that climate impacts are disproportionately created by those with more means, while the impacts are borne more by the people with fewer means. This strategy encourages those that have more means to take extra care to reduce their carbon footprints so that others in our community and around the world can lead healthier and safer lives.

Equitable engagement around climate action must continue. As the City implements this plan, implementation partners should consider the following:

- What resources are needed for residents of different backgrounds, income levels, ages and abilities to take action in this realm?
- How can climate action resources be made more accessible?
- What existing, trusted communication networks and channels can be used to raise awareness of the need for climate action?
- How are we measuring the impact of climate action strategies on our more vulnerable community members?

Co-benefits: Helping achieve Milwaukie’s Community Vision

In preparing this plan, the project team identified and ranked the “co-benefits” of each City-level mitigation and adaptation strategy. This co-benefit analysis recognizes that these actions are not stand-alone requests to serve one purpose; rather they each have the potential to help the City achieve its objectives set out in the Community Vision and forward other City goals (see Appendix D for full list of Vision superactions). Table 1 shows the scoring criteria assigned to six co-benefits.

Table 1. Co-benefits scoring criteria

Co-benefits	Co-benefit scoring criteria		
	1	2	3
Addresses Milwaukie Superactions: How well does the action support progress on the superactions defined in Milwaukie’s Community Vision?	Action addresses 1 superaction	Action addresses 2-3 superactions	Action addresses 4-5 superactions
Opportunity for Social Equity: How well does the action result in an equitable outcome for Milwaukie community members and improve social equity?	Serves some but not all	Serves all equally	Addresses inequities
Mitigates and Adapts in One Action: Does the action reduce the impact of climate change while also preparing	Does only one	Does only one better than the other	Does both well

us for changing future physical conditions?			
Revenue Generation or Cost Avoidance: Will the City spend or save money to implement this action?	Action is a net cost	Action is roughly break even	Action is a net profit or savings
Leverages Existing Efforts: Does this action build upon already adopted policies and strategies?	Needs funding and/or policy approval	Existing plans support	Already planned or underway
Community Support: How much community support is there for implementing this action?	Less than 25% likely to support	25-50% likely to support	Over 50% likely to support

Plan to action: What success looks like

This Climate Action Plan is meant to catalyze **action**. Our City, community, businesses, and regional partners must take urgent action—together—to address the threat of climate change.

Effectively planning for and mitigating climate change requires us all to take action on many levels. This plan is designed for several audiences:

- The City of Milwaukie; its departments, staff, services and facilities; and its agency partners
- Milwaukie households
- Milwaukie businesses and community organizations

Within the six topic-specific sections (Chapters 4a – 4f), the plan sets out strategies and concrete actions for each of these groups to take as we collectively tackle this challenge.

These actions and strategies will put us on a path to achieving our climate action goal: becoming a net zero building energy city by 2040, looking ahead to being carbon neutral by 2050. Chapter 2 explains these goals in more detail and what it will take to meet these targets.

To achieve our goals, we must monitor our progress and continue planning as our community grows and new technologies emerge. Milwaukie will employ a Climate Action Coordinator to manage implementation and monitoring of this plan. Appendix F includes metrics for each strategy proposed in this plan.

We can—and we must—act urgently to protect our planet, our community and our future. This Climate Action Plan gives us the tools to begin doing so, and in the process, help realize our community vision.

2. Our climate action goal

Our goal: Milwaukie will be a **net zero building energy city** by 2040, looking ahead to **being fully carbon neutral by 2050**

The science behind our climate action goals

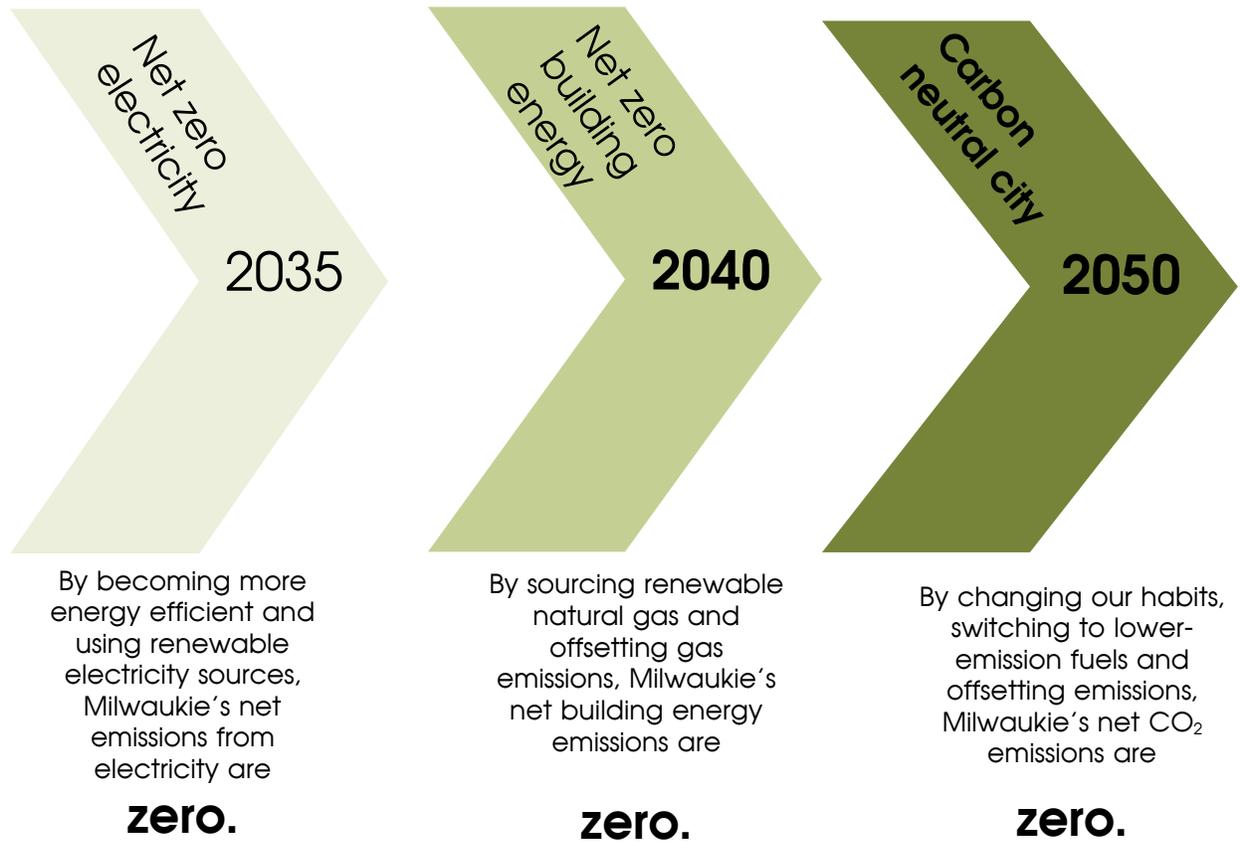
The United Nations International Panel of Climate Change (IPCC) has set a goal to keep global average temperature increase below 2°C (3.6°F) above pre-industrial conditions—often referred to as the “guardrail goal.” This correlates to keeping atmospheric CO₂ concentrations below around 450 parts per million (PPM)³. To achieve this, the IPCC states we must aim to be “carbon neutral” by 2050 and become “carbon negative” for the following 50 years – requiring us to pull greenhouse gases *out* of the atmosphere into our soils, vegetation on land and in our oceans, and through technologies that have yet to be tried at scale.

Milwaukie’s climate action goal—informed by the IPCC and advice from other climate experts—is to be a **net zero building energy city by 2040, looking ahead to being fully carbon neutral by 2050**. What does this mean for us?

- By 2035, Milwaukie will be a “net zero **electricity**” city, meaning we will emit no net emissions from our building electricity use
- By 2040, Milwaukie will be a “net zero **building energy**” city, meaning we will emit zero net emissions from our building electricity *and* gas use
- By 2050, Milwaukie will be fully “**carbon neutral**,” meaning we will reduce or offset our carbon emissions entirely.

³ As of July 2018, the Earth’s atmospheric CO₂ was 411 PPM. If we keep emitting at the same rate we are today (2018), by 2100, the atmospheric concentration of CO₂ will be 900 PPM, far beyond the guardrail goal.

Figure 1. Milwaukie's climate action goals

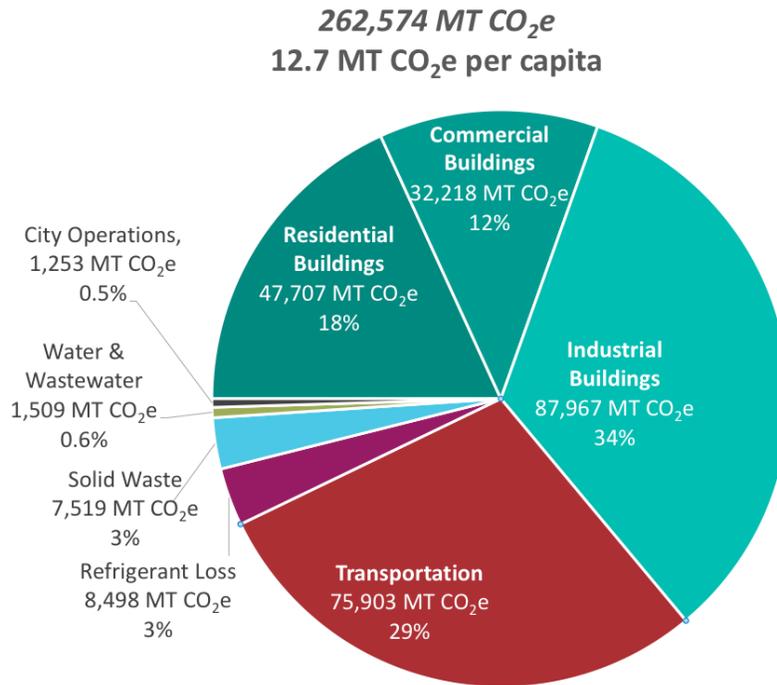


Milwaukie's carbon footprint

In 2016, Milwaukie generated approximately 262,574 MT CO₂e⁴ of local, sector-based emissions. Sector-based emissions are those that are generated inside of the community's geographic boundaries, including combustion emissions, emissions from electricity generation that serves the community and gasses that escape into the atmosphere, so called "fugitive emissions." Fugitive emissions include refrigerants for air conditioning that is released into the atmosphere.

⁴ Metric tonnes of carbon dioxide equivalent (MT CO₂e) is the conventional unit for reporting greenhouse gas emissions.

Figure 2. Milwaukie's sector-based greenhouse gas emissions



Milwaukie's sector-based emissions are similar in many ways to other communities around Oregon. These emissions shown in Figure 2 come primarily from combustion of natural gas and electricity use in buildings (green slices of the pie) as well as gasoline and diesel combustion in vehicles to move people and goods (red slices of the pie). Relatively small sources of emissions come from City government operations, landfill disposal of community solid waste, treatment of water and wastewater, and refrigerant gas loss from buildings and vehicles. Milwaukie's industrial sector represents a larger fraction of sector-based emissions compared to other Oregon communities of similar size due to its large employment base.

The greenhouse gas inventory only considers items that we can measure or estimate now. The City will endeavor over the coming years to find better data and estimations for our community's emissions and mitigating actions. There are two specific areas to note:

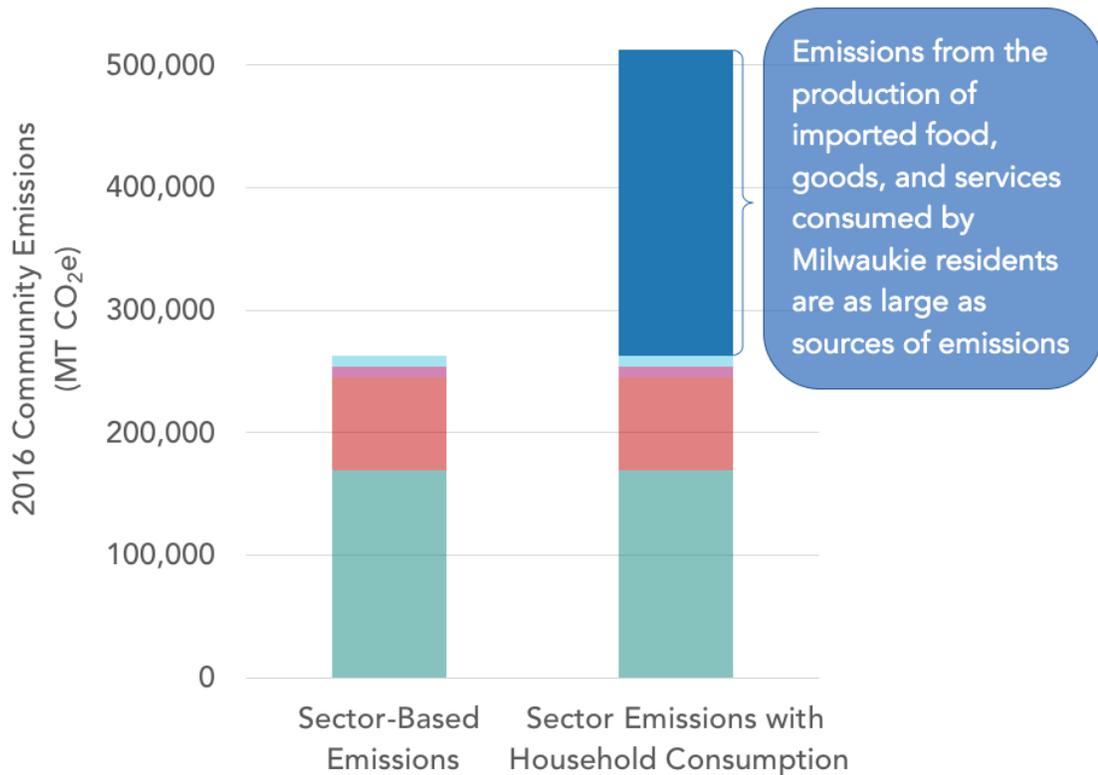
1. Corporate and organizational consumption of materials and the "imported" emissions associated with those are not in our current inventory. To date, there is no way to estimate the scale of this due to the variety of entity types and scales.
2. There is currently no way to track the reduction in consumption emissions of households over time without extensive surveying and in-home studies.

As methodologies emerge, Milwaukie will deploy them to be more comprehensive and act on what we learn.

What about the emissions from goods we buy that are made outside of Milwaukie?

In addition to accounting for sector-based emissions, Milwaukie’s Community Greenhouse Gas Inventory also considers emissions that are generated outside of the community during the production of goods, food, energy and services that are consumed by residents of Milwaukie. These emissions total approximately 257,175 MT CO₂e. Added to the sector-based emissions, **Milwaukie’s carbon footprint is approximately ~519,749 MT CO₂e (Figure 3)**⁵. For a sense of scale, this quantity of emissions is equivalent to the carbon sequestered annually by 600,000 acres of average United States forest – a land area about 400 times the size of the City of Milwaukie.

Figure 3. Milwaukie’s community carbon footprint, including household consumption



⁵ Note this does not include corporate consumption of materials.



How fast do we have to change?

Our climate action goal implies a specific rate of emissions reduction overtime (Table 2). On average, our community needs to reduce our emissions by on average 3% each year between now and 2050. While Milwaukie’s goal implies reaching a 100% reduction in emissions by 2050, it also assumes the community will continue to reduce emissions “beyond zero” after 2050.

Table 2. Annual emissions reductions associated with different average temperature increase targets

Target	Cumulative reduction			Average annual reduction
	2020	2030	2050	
Carbon neutral by 2050	15%	35%	100%	3%

Implementation timeline: planned City actions

To see how close we will get to that 3% per year average target, technical staff and the CAPC recommended targets for when the City should implement each City-level action or strategy over the next 10 years. This “roll out schedule” determines the rate of emissions reduction from the City strategies in this plan by 2035 (Table 3). The project team used the year 2035 as it is commonly used by other agencies, policy groups and climate scientists to forecast emissions models. This date allowed for an “apples to apples” comparison of reductions that will occur due to already adopted local, regional and federal policies and reductions from actions in this plan.

Table 3. Projected emissions reductions from City-level actions and strategies

	2021	2023	2025	2027	2029	2031	2033	2035
Reductions from prioritized City-level strategies in the Climate Action Plan (MT CO₂e)	11,631	25,214	42,940	61,907	80,873	99,839	118,805	137,771
Reductions from BAU* existing policies (MT CO₂e)	5,813	11,625	17,438	23,250	29,063	34,875	40,688	46,500
Total reduction (BAU + Climate Action Plan) (MT CO₂e)	17,444	36,839	60,378	85,157	109,935	134,714	159,493	184,271
Percent reduction of community-wide 2016 emissions	7%	15%	24%	34%	43%	53%	63%	73%

*BAU = business as usual. These numbers are estimates for greenhouse gas reductions if technical potential is met and existing regional, state and federal policies are implemented.

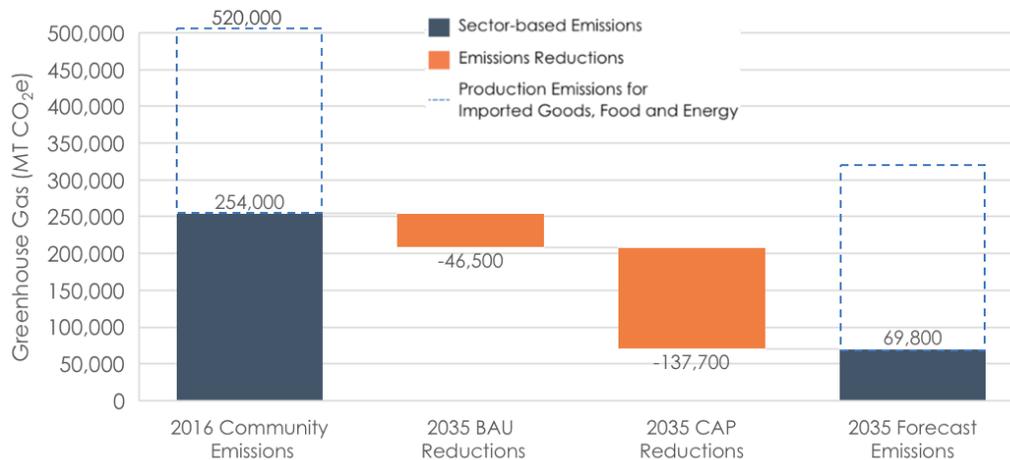
How far do City actions get us?

The project team scaled the mitigation potential of the City-level actions identified in this plan to see how far this gets us toward our goals.⁶ Figure 5 shows estimated reductions in annual CO₂e emissions by 2035. The first column shows Milwaukie’s estimated carbon footprint⁷ of 519,749 MT CO₂e. The first orange step down shows the emissions reductions expected from existing regional, state, and federal policies. This is what is frequently called the Business as Usual (BAU) scenario, in which all policies are scaled as if they are to be implemented. Policies considered include:

- Oregon’s Renewable Portfolio Standard (RPS)
- Federal Vehicle Corporate Average Fleet Economy (CAFE) standards
- Oregon SB263 Opportunity to Recycle Goal and Recovery Rate Updates (for food waste recovery)
- Montreal Protocol on Refrigerants
- Energy Trust of Oregon’s Cost-Effective Energy Efficiency

The other orange step in Figure 4 shows us how far the prioritized and scaled City actions from this Climate Action Plan get us by 2035. It does not include actions to be determined in future climate action plans that get Milwaukie to carbon neutrality by 2050.

Figure 4. Forecasted emissions reductions from existing policies and Climate Action Plan actions



In total, existing policies and the strategies set out in this Climate Action Plan are forecast to reduce emissions by 186,500 metric tonnes of CO₂e – or 73% – compared to 2016 community emissions by 2035.

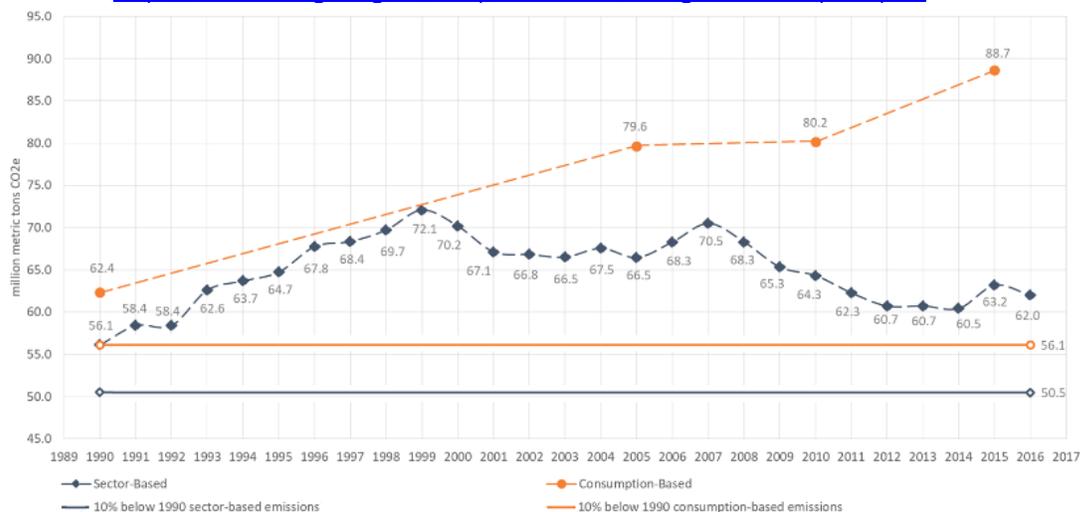
⁶ Actions and strategies recommended for households, businesses and organizations have not been scaled at this time.

⁷ This includes the amount of emissions (CO₂ equivalent) **produced** in Milwaukie annually from our buildings, vehicles and industry and an estimate for the CO₂e emitted elsewhere to produce the goods Milwaukians consume.

This leaves a significant gap for us to close by 2050. In short, the City actions in this plan along with existing programs at the state, federal and international levels are not enough to achieve our climate goals. This is due to technological and political constraints. For example, reducing the carbon footprint of Milwaukie to zero by 2050 implies that everything that community members buy in the future needs to be made carbon free – wherever in the world it is made. Additionally, the United Nations IPCC assumes that to get to carbon neutral by 2050 requires the dramatic scale up and deployment of carbon sequestration technologies that come online by 2035, even though most of those technologies are just being thought of now. The effort that is required for this to occur implies an effort that is of similar scale to war time efforts that have not been seen since the 1940s.

Furthermore, while Oregonians are rapidly de-carbonizing our local emissions, *at the same time, we are buying more goods made elsewhere from higher emitting energy sources and are de-facto increasing our emissions* (see Figure 5). While these emissions don't come from our state, our consumption patterns are responsible for this growth.

Figure 5. Trends in Oregon sector-based and consumption-based GHG emissions, 1990-2015 - <http://www.oregon.gov/deq/FilterDocs/OregonGHGreport.pdf>



Closing the gap

What does this mean for our strategy? To reach our goal of being carbon neutral by 2050—in other words, to “close the gap,”—we must accelerate our mitigation efforts, and we all must pitch in.

The following chapters set out strategies and actions households, businesses and other community members can take to help us close the gap. Bold, urgent action is needed on all levels to achieve the magnitude and rate of change we need to avoid dire effects of climate change. These actions range for simple changes we can all make today to larger strategies that will take coordination and collaboration.

In addition to executing the actions in this plan, the City of Milwaukie will work to build staff and community capacity to further close this gap. These measures include:

- Ensuring that Climate Action remains a high priority to assure there is sufficient staffing levels to put the plan into action, identify new opportunities for increased action, and provide resources and support to community members and partners.
- Enabling collaboration on goals between City Departments, engagement, information exchange and education.
- Reviewing and updating the Climate Action Plan every five years and updating the community greenhouse gas inventory every 1-3 years.

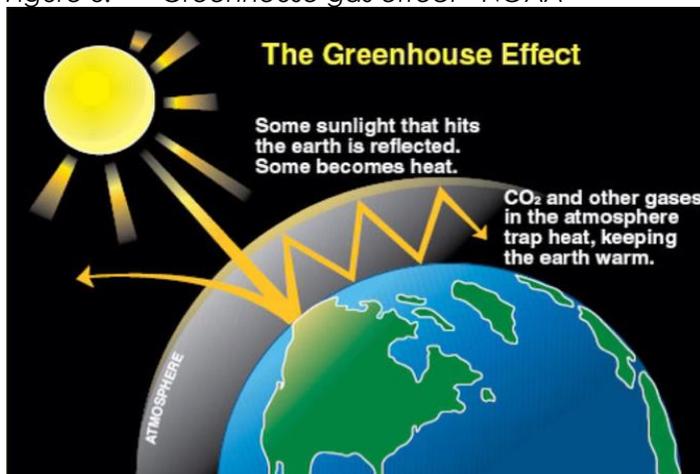
Our climate action goal is ambitious but doable—we *can* change and we *will* change. But *why* must we change? Chapter 3 explains the reason our climate is changing and what we can expect to experience if we do nothing to counteract our rising global temperatures.

3. Climate change explained

Greenhouse effect

Climate change is a continuous and evolving condition that is caused by air emissions that are created from combustion and from gases that escape into the atmosphere. When these emissions (called Greenhouse Gases or Greenhouse gases for short) enter the atmosphere, they act as a glass greenhouse around the Earth that holds heat in and do not allow for much of the warmth to release into space (see Figure 6). As the planet warms, the conditions in each place change. In some areas the changes may be dire, making them ultimately uninhabitable due to heat or flooding from expanding warmer water and melting arctic ice.

Figure 6. Greenhouse gas effect - NOAA



While Figure 6 shows a large band around the planet that is trapping the heat in, the atmosphere actually is a lot thinner. It starts at the Earth's surface and only goes to about seven miles high (Figure 7). This is roughly the height where commercial jets fly.

Figure 7. The Earth's atmosphere - NASA



The average American family emits about 80 metric tonnes (2,200 lbs – international unit) of greenhouse gases each year from our cars, electricity, heat, air travel and the materials we buy. Figure 8 shows how much volume a metric tonne of greenhouse gases actually fills. With 126.22 million households in the United States alone, these emissions add up quickly.

Figure 8. Volume of one metric tonne of greenhouse gases – carbonvisuals.com



Causes of rise in emissions

The dramatic growth in emissions in the last 150 years can be explained by a few simple facts. First and foremost, we have many more people on Earth than we ever have before (Figure 9). This growth happened concurrently and interactively with the Industrial Revolution, during which machines and energy use (mostly through burning wood, oil and coal) gave rise to a higher level of comfort and safety for humans, thus allowing for an increase in population. This has resulted in an exponential growth in GHGs that are altering the climate patterns around the Earth.

Figure 9. Global population growth – University of Virginia

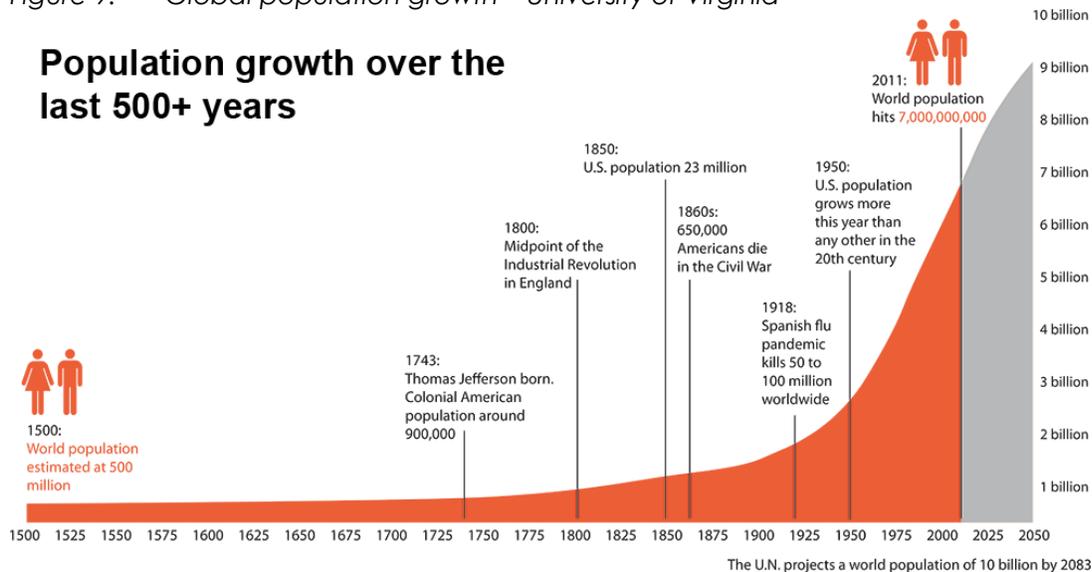
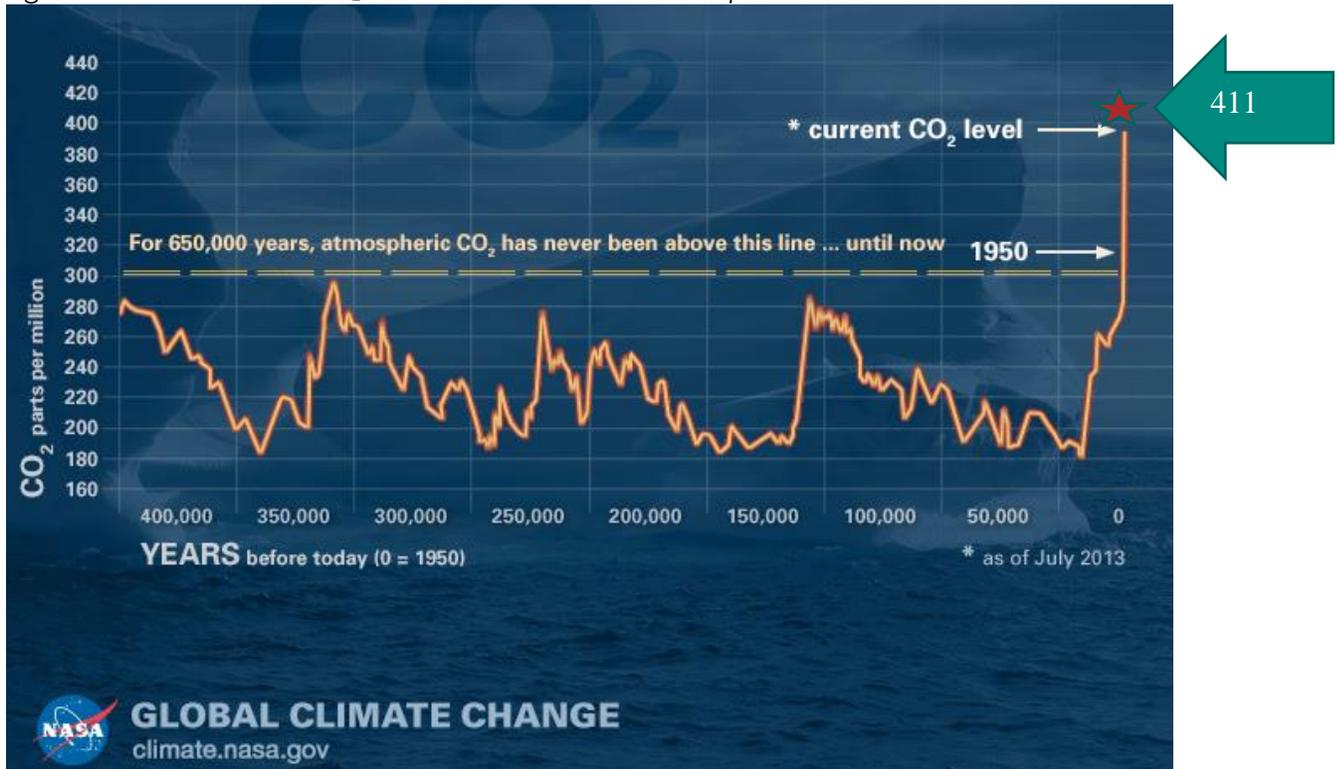


Figure 10 shows the increase in atmospheric CO₂ concentrations over time. For 650,000 years, atmospheric CO₂ stayed below 300 PPM. As population began to skyrocket into the 20th century, the atmospheric CO₂ concentration increased exponentially. As of June 2018, the concentration of atmospheric CO₂ is 411 PPM. If all greenhouse gases are considered, this number rises to about 490 PPM.

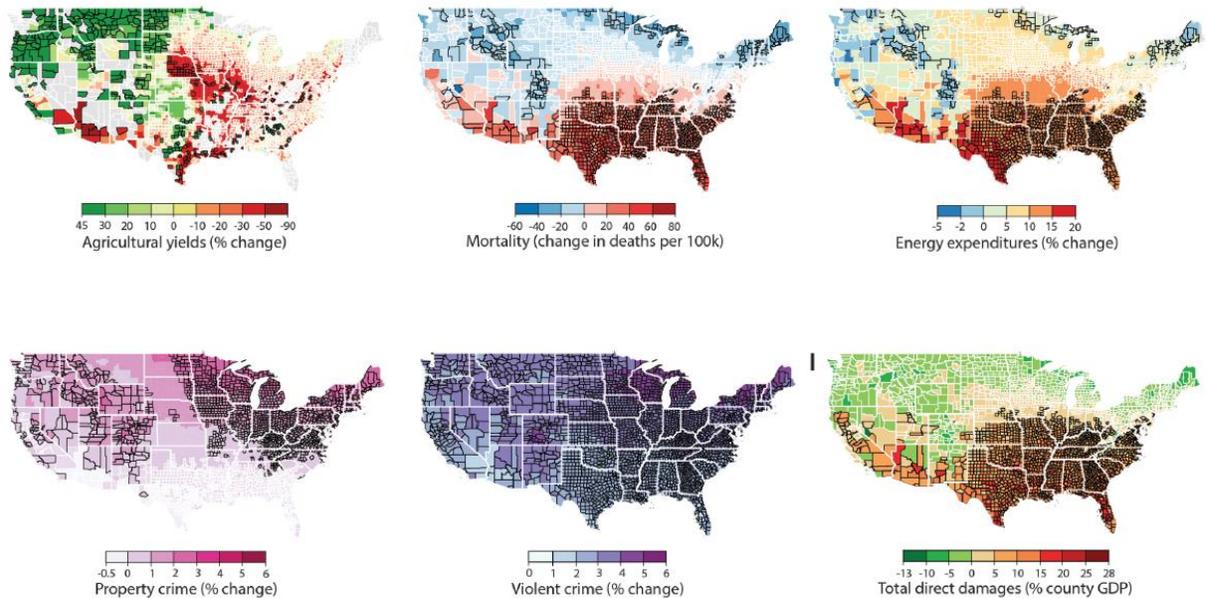
Figure 10. Increase in CO₂ concentrations in the atmosphere over time - NASA



How will climate change affect the United States?

If climate change is not slowed or reversed, the United States will experience many significant impacts by the end of this century. Coastal areas and tidal rivers will be affected the most due to rising sea levels. In simple terms, conditions will get hotter throughout the United States, with already hot places becoming near uninhabitable, causing plants and other creatures to go extinct or to migrate north. This includes food crops such as grains and produce that are currently grown in the Midwest. The shortages in crops will undoubtedly send price shockwaves through our population and will threaten the wellbeing of the poorest people of our country and our world. A 2017 study estimated economic benefits and damages county by county related to climate change by 2090, aggregating estimates from several other studies (Figure 11). Figure 11 shows the South bearing much of the burden of climate change, while some trends like property and violent crime increase in the northern states (likely due to migration and population increase). Northern states are generally expected to experience economic growth while southern states experience economic damages.

Figure 11. Estimating economic damages from climate change in the United States⁸ - Hsiang et al., *Science* 356, 1362–1369 (2017) 30 June 2017.



How will climate change affect Milwaukie?

While the Pacific Northwest will do better than much of the United States, that likely means that this region will see a large migration of people from other parts of the country. Climate studies by Oregon State University’s Oregon Climate Change Research Institute (OCCRI) and the Oregon Health Authority outline the likely changes that we can expect in Milwaukie and the Willamette Valley area. The following sections outline some of those changes and impacts that principally focus on temperature, precipitation, more frequent storms, and wildfire events.

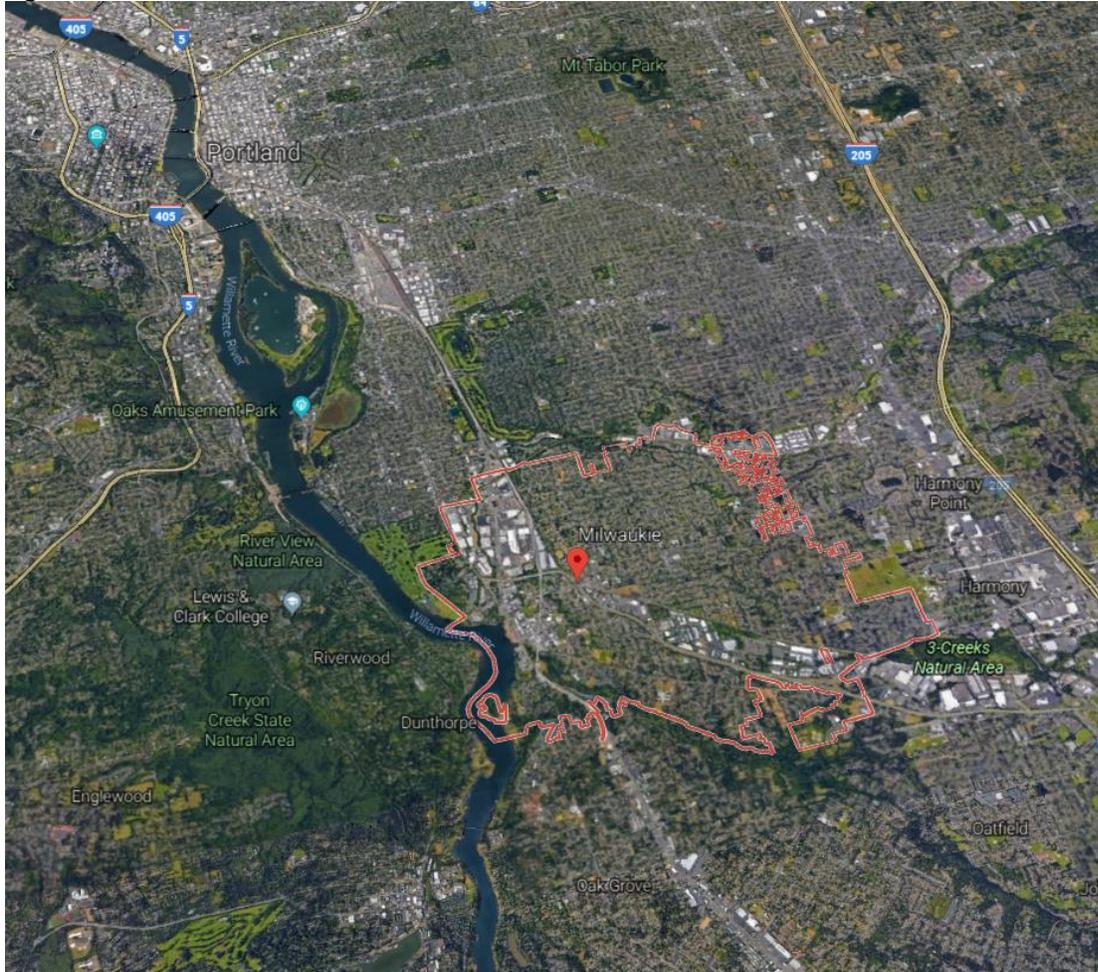
Population Shift

Due to Milwaukie’s location and expected climate, the City can expect a continued growth in population as climate refugees look for new communities where water is not scarce and the temperatures in the summer are bearable. While the rate and total number of people that will migrate north is unknown, the economic damages projected in Figure 11 indicate that the southern United States will de-populate to avoid economic hardship, more extreme weather and an increase in mortality rates due to the across the board stressors on the human body and the societies. This population growth will undoubtedly challenge the government structures to provide services and will likely change the cultures of the area including politics and crime – both property and violent. That said, the maps in Figure 11 also show agriculture and economic

⁸ Data shown for counties without black lines around them have an 85% confidence rate, and data shown for counties with a black outline have a 95% confidence level.

growth. While this will provide an opportunity for many, how that opportunity is apportioned to different segments of the population is unknown.

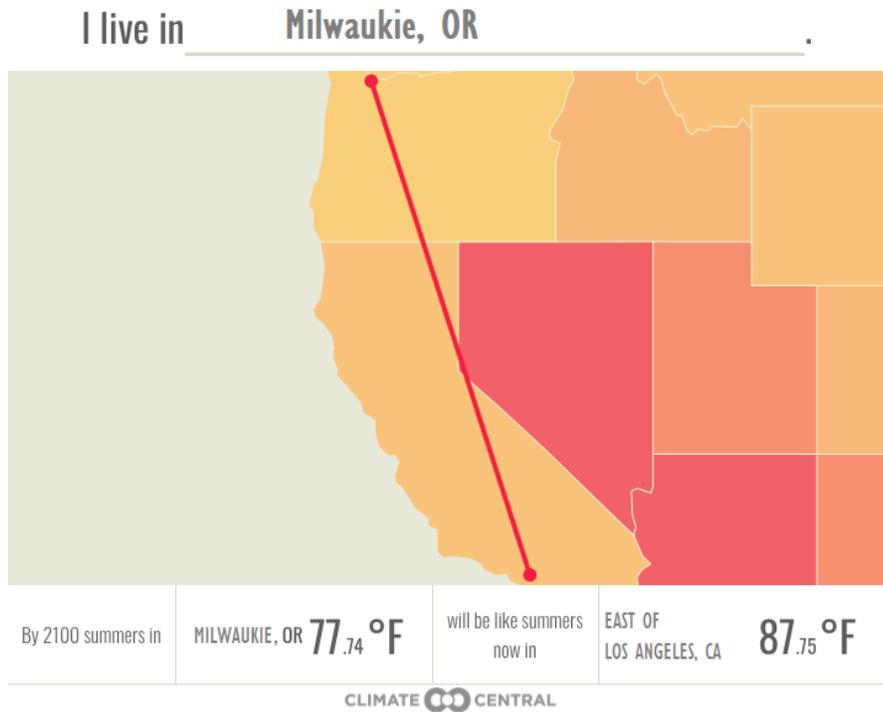
Figure 12. Boundaries of Milwaukie and location within the Portland metro area



Warm dry season

By 2100 in the Portland metro area, we can expect that our summer average temperature, currently 78°F, will be more like the average summer in cities just east of Los Angeles, California at 88°F summer average (Climate Central, 2014) (Figure 13). In the past decade, we generally have experienced one day above 100°F annually, but by 2100 we can expect 22 days that are above 100°F (Climate Central, 2017). While the average temperatures may seem bearable, keep in mind that the 2-3-week periods we experience today when temperatures reach into the high 90s°F will in the future be hovering around 110°F.

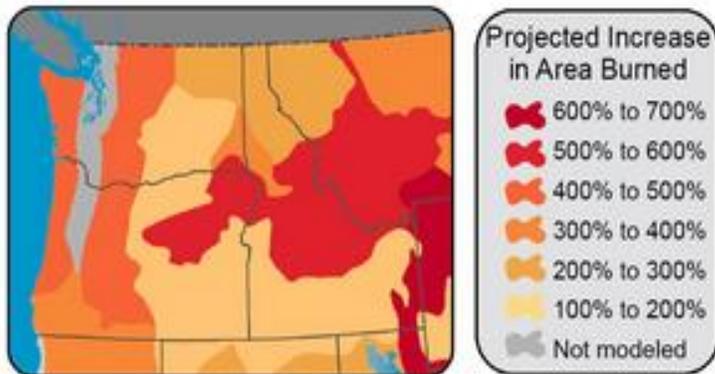
Figure 13. Forecasted summer temperatures in 2100 – Climate Central



Regional Wildfire Risk

The Portland metro region is fairly safe from direct burning due to wildfires, although the urban wildland interface (cities close to the boundaries of agricultural and natural resources land) are susceptible. In the past few years, however, we have experienced more wildfire in the Pacific Northwest, a condition that will increase over the next few decades. OCCRI’s analysis has projected the likely scenarios of increased burning in the Northwest. Figure 14 shows the projected increase in fire disturbance. By 2040, we can anticipate a 400% to 500% increase in the number of acres burned. In 2017, Oregon wildfires burned approximately 46,000 acres. That area is roughly 15 times the acreage of Milwaukie. The expansion of that fire area to 500% is roughly 230,000 acres or 74 “Milwaukies” worth of land area.

Figure 14. Increase in wildfire surface area burned by 2040 - OCCRI



Milwaukie residents will experience significant air quality impacts as surrounding regions burn during the summer months. In the summers of 2017 and 2018, the metro area suffered when winds brought smoke from over 100 fires in British Columbia and then multiple Oregon and Washington fires, including the Eagle Creek Fire in the Columbia Gorge National Scenic Area.

Elk Rock Island from Milwaukie Bay Park during smoky conditions in 2018 (Photo: Peter Passarelli)



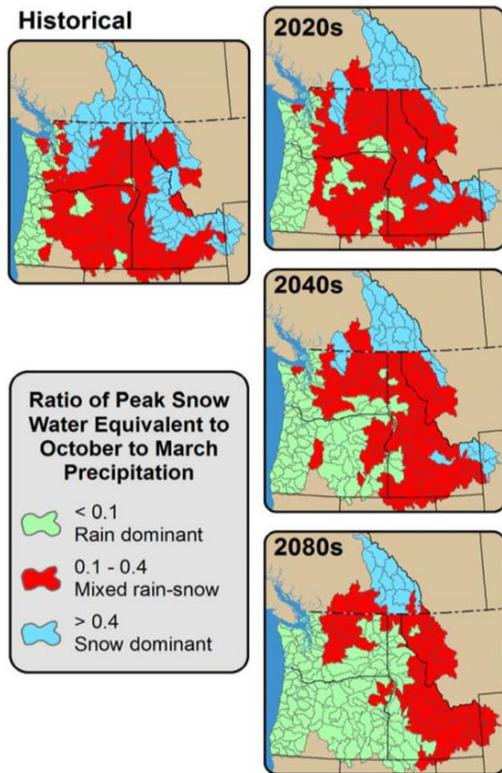
Water source risk

One of the most significant changes we are already experiencing is the shift in precipitation from snow to rainfall in the winter months. Figure 15 shows the shift in many areas from snow dominant and mixed rain-snow precipitation in many areas to rain dominant precipitation.

Historically, Milwaukie's wet season precipitation has been primarily rain, but the winter snow in the Cascades serves as storage for our rivers, streams, and groundwater. The reduction in snowfall means our rivers and streams will not have the same quantities of flowing water from the melting snow in summer months. This lower volume of water increases risks to our drinking water supply; agricultural irrigation; habitat for fish species like salmon, sturgeon and trout; hydroelectric power generation; and some of our favorite water recreations such as swimming, boating, fishing and rafting.

Ultimately, this water is the life source for us and nature. As we experience climate change, we will need to learn to become more resourceful in our collective use and reuse of this resource.

Figure 15. Change from snow-dominant to rain-dominant precipitation by 2080 – National Climate Assessment, 2014



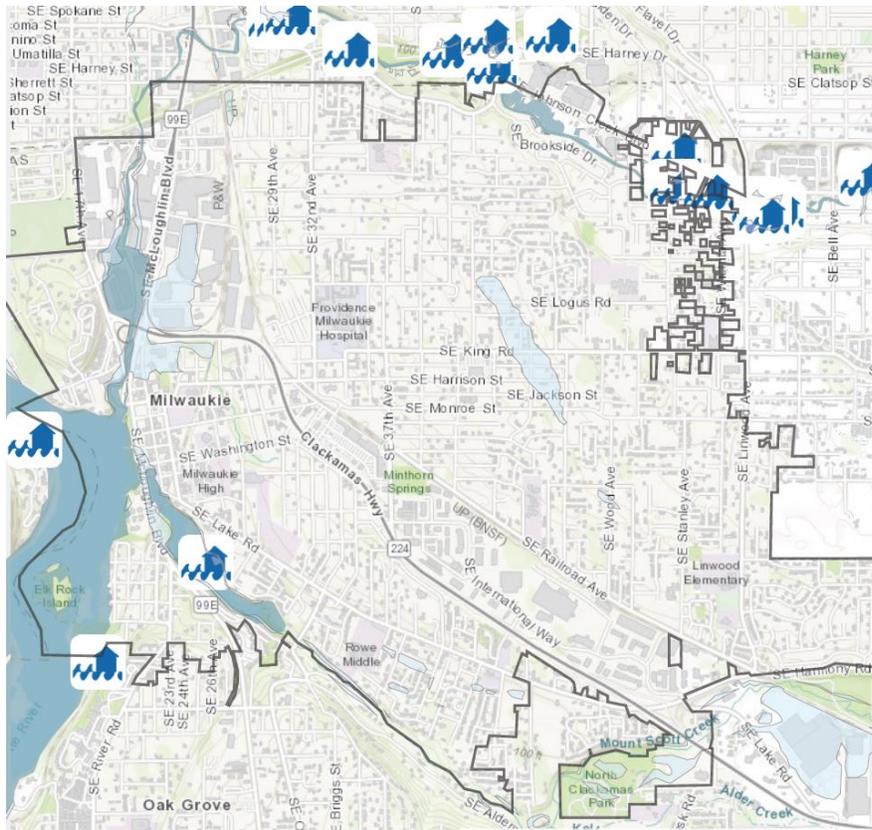
Wet season

Flood risk from precipitation

Milwaukie has experienced flooding in the past, and previously flooded sites are the most susceptible to flood again. In February 1996, three quarters of Clackamas County’s residents were affected by a flood and represented one third of all claims filed statewide for the Federal Emergency Management Agency’s (FEMA) National Flood Insurance Program. The Christmas Flood of 1964 and floods in 1861 and 1890 each exceeded 100-year flood marks⁹. Figure 16 shows the extent of the 1996 Milwaukie flood. Flood risk for Milwaukie is focused on areas where rivers and streams are adjacent to land.

⁹ The term "100-year flood" is used in an attempt to simplify the definition of a flood that statistically has a 1-percent chance of occurring in any given year.

Figure 16. Milwaukie flood area



Key:

Light blue areas:
Areas located in 500-year flood plain (0.2% annual chance flood hazard)

Dark blue:
Areas that flooded in the 1996 flood

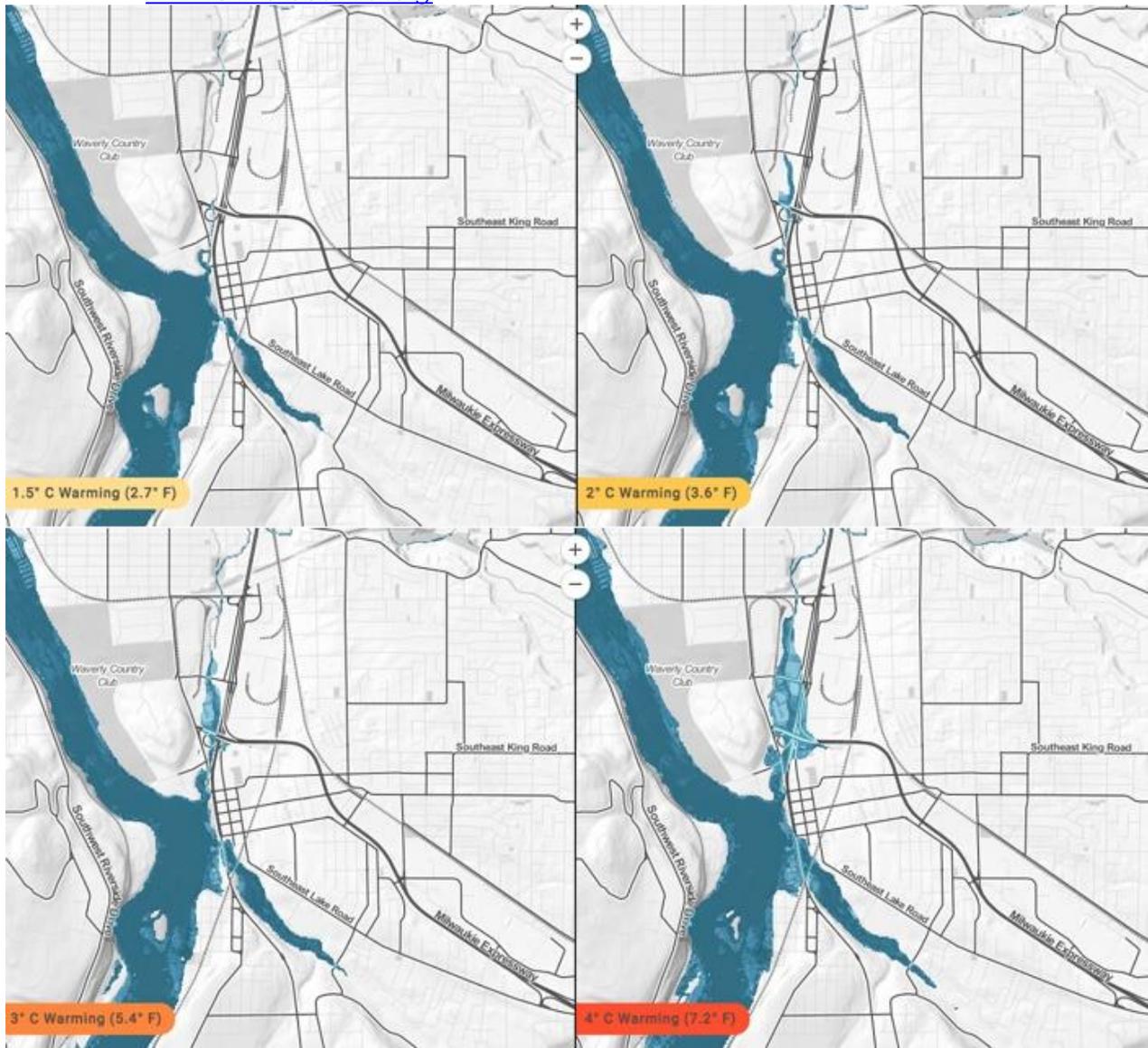

Locations of significant flooding in 1996

Flood risk from sea level rise through the tidal effects on the Willamette River

The Columbia River is influenced by the tides up-river until it meets the Bonneville Dam complex. This tidal effect also occurs in the Willamette River upstream until it meets Willamette Falls. The tidal effect of the river will generate flooding as the sea level rises, independent of precipitation in the wet months (Figure 17). Figure 17 shows the local impact of projected sea level rise by 2100 in four different scenarios related to approximate atmospheric concentrations of greenhouse gases: 400 PPM (1.5°C); 450 PPM (2°C); 700 PPM (3°C) and 900 PPM (4°C).¹⁰ Each concentration number (parts per million) correlates with a global average annual temperature increase. The 900 PPM scenario assumes we continue emitting the emissions we currently emit globally with population growing. In all scenarios, the water level rises, but under the 900 PPM scenario, Milwaukie Riverfront Park, the entire Kellogg Wastewater Treatment Center and the OR-224/99-E interchange would be flooded by 2100.

¹⁰ We start with 400 PPM (1.5°C) since global concentrations of CO₂ alone are at 411 as of June 2018.

Figure 17. Tidal effects on the Willamette River from sea level rise under different temperature scenarios ranging from 400 PPM / 1.5°C to 900 PPM - 4°C¹¹. - www.Climatecentral.org



¹¹ Note that the flooding modeled in these Figures does not include rainfall events – just tidal increases.

4. Topic-specific strategies and actions

The following chapters set out specific actions and strategies for the Milwaukie community to take to move toward our climate action goals. Each chapter contains the following sections:

- Topic overview and proportion of total Milwaukie emissions
- Prioritized mitigation and adaptation actions and strategies for City and partner implementation
- Emissions reductions overtime from these City actions and strategies
- “Mind the gap”: How far do these City strategies get us?
- Actions and resources for Milwaukie households and organizations

Mitigation and adaptation

The City implementation actions are categorized into *mitigation strategies* and *adaptation strategies*.

- *Mitigation actions* will reduce the emissions that come from producing energy to make our goods, food and to move us, keep us warm and keep us cool.
- *Adaptation actions* will prepare for the changing physical conditions that are arriving now, such as temperature and wildfire increases.

Table 4 summarizes the number of actions per topic category:

Table 4. Number of actions per topic

Topic	City-level mitigation actions	City-level adaptation actions
Building energy and efficiency	7	1
Vehicle fleets and fuels	7	2
Land use and transportation planning	9	4
Materials use, purchasing and recovery	7	0
Natural resources	0	7
Public health and emergency preparedness	0	5

Climate action strategy key

The project team analyzed the actions and strategies for City and partner implementation based on when they should be implemented, mitigation potential (where possible), anticipated net cost savings/expenditure, and their potential for achieving other “co-benefits.” Tables in each chapter summarize the results of this analysis using the following key:

Figure 18. Climate action strategy key



Implementation

- O** City operations
- L** City law/code
- E** City educates
- SF** City partners to lobby state and federal government
- C** City partners for collective action
- P** Partners lead

Implementation timescale

- Short-term = 0 – 2 years
- Mid-term = 3 – 6 years
- Long-term = 6+ years

Cost/savings per MT CO₂e reduced

- \$** \$0 - \$40 \$ Net savings per MTCO₂e reduced
- \$\$** \$41 - \$360 \$ Net cost per MTCO₂e reduced
- \$\$\$** \$361 - \$680
- \$\$\$\$** \$681 - \$1,000

Co-benefits

- Addresses Milwaukee's superactions
- Opportunity for social equity
- Mitigates and adapts in one action
- Revenue generation or cost avoidance
- Leverages existing efforts
- Community support

Carbon impact

- Reduces annual GHG emissions by less than 500 metric tons or lays the foundation for other efforts, though by itself may not reduce emissions measurably
- Reduces total annual GHG emissions by 500 to 1,000 metric tons
- Reduces total annual GHG emissions by 1,000 to 2,500 metric tons
- Reduces total annual GHG emissions by 2,500 to 5,000 metric tons
- Reduces total annual GHG emissions by more than 5,000 metric tons

4a. Building energy and efficiency

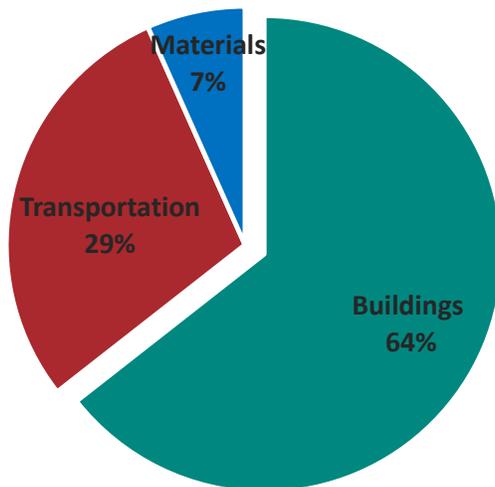


This chapter discusses reducing emissions from the energy used to power our homes and offices, run our appliances and build new structures.

Why it matters

Building energy comprises 64% of our community's local carbon footprint (Figure 19). We use energy in our homes to make ourselves comfortable, provide light at night, keep our food preserved, wash our clothes and bodies and run our electronics. At work, we use energy for many of the same things, but also for making money via the production of goods, services or knowledge. Milwaukie's portion of building energy derived emissions is greater than most other Oregon communities, due to the large industrial base that remains in our community

Figure 19. Building energy portion of all sector-based emissions in Milwaukie



The energy we use in buildings is predominantly composed of methane burned onsite to produce heat and electricity, which is made from many sources of power generations including hydropower, coal, methane, and solar. Figure 20 shows the distribution of power generation types in the Pacific Northwest

Building energy and efficiency-related plans and policies

Milwaukie Community Vision

Milwaukie Comprehensive Plan

Clackamas County Sustainability Policy

Clackamas County Natural Hazards Mitigation Plan

North Clackamas School District # 12 policies

PGE Integrated Resource Plan

Energy Trust of Oregon Strategic Plan

Metro Climate Smart Strategy

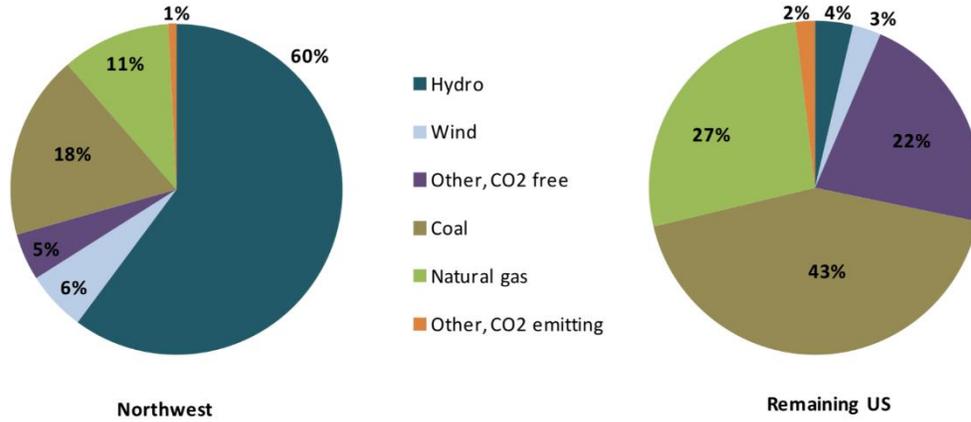
Oregon Renewable Portfolio Standard

Oregon Biennial Energy Plan

Oregon 10-year Energy Plan

and in the United States. While we are certainly lower carbon than the rest of the United States, we have a long way to go to reduce emissions from our power.

Figure 20. Power generation mix in the Pacific Northwest compared to the rest of the United States – PNUCC 2014, “Carbon Emissions – A Northwest Perspective”



Reducing our need for power starts first and foremost with energy efficiency. Once we’ve improved the efficiency of our buildings through weatherization and other specific efforts, we then must look to purchasing more renewable or low carbon power. In Milwaukie, this means subscribing to NW Natural’s Smart Energy program, which buys carbon offsets for the use of your gas, and Portland General Electric’s Green Source or Clean Wind program. Milwaukie is already working with both partners to develop plans for meeting our emission reduction goals.

Plan to Action! Milwaukie is already getting to work

PGE Path to Zero: Milwaukie is working with PGE on a comprehensive “Path to Zero” strategy for our community. Energizing Milwaukie’s future has four key components:

Infrastructure	Energy Mix	Transportation Electrification	Clean Energy Future Challenge
<ul style="list-style-type: none"> • Smart, more efficient streetlights: Replacement of non-LED streetlights downtown with LED smart lights 	<ul style="list-style-type: none"> • Green future city: Opportunity to purchase bundled Renewable Energy Certificates • Smart neighborhoods project: Demonstration showing the potential for energy storage, expanded demand response and rooftop solar 	<ul style="list-style-type: none"> • Electric vehicle (EV) charging stations: Implementation of more EV stations downtown and at multi-family complexes • Electric shuttles and buses: Opportunities to bring electrified transit to Milwaukie • Public works vehicle conversion: Replacement of City vehicles with EVs 	<ul style="list-style-type: none"> • A year-long, co-branded campaign to support Milwaukie’s goal to become a Net Zero Electricity city by 2035.

City-level strategies and actions

Prioritized City-level mitigation strategies

Table 5 presents the strategies and actions prioritized through the climate action planning process related to building energy and efficiency. The table summarizes the City’s role in each action, the approximate timescale for implementation, relative levels of greenhouse gas reductions, and the net cost or savings per MT CO_{2e} reduced (this cost/savings is assumed by the lead implementer of the action). The table also shows the results of the project team’s co-benefits analysis.

Table 5. Building energy and efficiency – City-level mitigation strategies

MITIGATION STRATEGIES

Buildings Energy Sourcing and Efficiency

Action	How will this be implemented?	When will the action be completed?	Potential GHG reductions	Cost/savings per MTCO ₂ e reduced	Co-benefits
IN PROGRESS Work with PGE to become net zero by 2035	C	▶▶▶	████████ x10	Cost data unavailable	3 — 2 — 1 — \$ net savings \$ net expenditure
Engage NW Natural to develop strategy for being net zero by 2040	C	▶▶▶	████████ x10	\$	3 — 2 — 1 — \$ net savings \$ net expenditure
Adopt a commercial and residential building energy score program based on City of Portland's	L C	▶▶▶	████████	\$\$	3 — 2 — 1 — \$ net savings \$ net expenditure
Develop micro-grids and energy storage systems in conjunction with renewables	SF P	▶▶▶	████████	\$\$	3 — 2 — 1 — \$ net savings \$ net expenditure
Work with PGE on demand response program	C	▶▶▶	████████	Cost data unavailable	3 — 2 — 1 — \$ net savings \$ net expenditure
IN PROGRESS Advocate for more energy efficiency state building codes	SF	▶▶▶	████████	\$	3 — 2 — 1 — \$ net savings \$ net expenditure
Incentivize property owners to encourage multifamily energy efficiency upgrades	L C	▶▶▶	████████	\$\$	3 — 2 — 1 — \$ net savings \$ net expenditure
Develop community solar project	C	▶▶▶	████████	\$\$	3 — 2 — 1 — \$ net savings \$ net expenditure

O City operations	L City law/code	E City educates	C City partners for collective action	P Partners lead, City participates	SF City partners to lobby state/feds	▶▶▶ Short term	\$ net savings	3 high
Addresses Milwaukee's superactions	Opportunity for social equity	Mitigates and adapts in one action	Revenue generation of cost avoidance	Leverages existing efforts	Community support	▶▶▶ Mid term	\$ net savings	2 medium
						▶▶▶ Long term	\$ net expenditure	1 low

Plan to Action! Ways Milwaukie can get to work

Commercial and Residential Energy Score System: Milwaukie will adopt a commercial and residential energy score program as part of this plan. Other cities, including Portland, use energy score systems to catalyze change and encourage energy efficiency improvements.



Prioritized City-level adaptation strategies

The City of Milwaukie must also act to plan for future physical conditions to ensure safety and ongoing service to the community. The strategy in Table 6 will help Milwaukie prepare our buildings for resilience in weather events.

Table 6. Building energy and efficiency – City-level adaptation strategy

ADAPTATION STRATEGIES

Buildings Energy Sourcing and Efficiency

Action	How will this be implemented?	When will the action be completed?	Co-benefits
Implement solar, battery storage, and micro-grids for resilience in weather events	C	»»»	3 — 2 — 1 —

City operations	City law/code	City educates	City partners for collective action	Partners lead, City participates	City partners to lobby state/feds	Short term	3	high
Addresses Milwaukie's superactions	Opportunity for social equity	Mitigates and adapts in one action	Revenue generation of cost avoidance	Leverages existing efforts	Community support	Mid term	2	medium
						Long term	1	low

Emissions reductions over time from prioritized actions

Table 7 shows the expected emissions reductions by 2035 if these actions are implemented.

Table 7. Projected emissions reductions from City-level actions and strategies

	2021	2023	2025	2027	2029	2031	2033	2035
Reductions from prioritized City-level strategies in the Climate Action Plan (MT CO ₂ e)	11,321	23,943	37,581	52,459	67,337	82,215	97,093	111,971
Reductions from BAU* existing policies (MT CO ₂ e)	4,313	8,625	12,938	17,250	21,563	25,875	30,188	34,500
Total reduction (BAU + Climate Action Plan) (MT CO ₂ e)	15,634	32,568	50,518	69,709	88,900	108,090	127,281	146,471
Percent reduction of 2016 emissions from building energy	9%	19%	30%	41%	53%	64%	75%	87%

*BAU = business as usual. These numbers are estimates for greenhouse gas reductions if technical potential is met and existing regional, state and federal policies are implemented.

Mind the gap: How much more do we have to do?

Looking ahead to the full implementation of the plan (including natural gas-related strategies that will be implemented after 2035), City-level strategies and the actions already planned through existing policies at the local, state and federal level result in a 93% reduction in total sector-based greenhouse gas emissions related to building energy and efficiency (Figure 21). *Note: this does not include household or corporate consumption. This leaves a gap of 7% to get to carbon neutral from building energy.* To close this gap, Milwaukie households, businesses and other organizations must also take swift action.

Figure 21. Reduction in 2016 greenhouse gas emissions from building energy and efficiency City-level strategies and existing policies and gap to close to be carbon neutral



Closing the gap: Household and organizational actions

The following Figures provide ideas for ways organizations, households and businesses can take action and help us reach our goals.

[NOTE: These tables will be replaced in the final CAP with infographics. Please share your thoughts and ideas on additional resources to highlight on these tables]

Table 8. *Building energy and efficiency - Household actions and resources*

Actions to take	Organizational resource	Links to learn more
If you have natural gas, Buy Smart Energy from NWN	NWN	https://www.nwnatural.com/Residential/SmartEnergy
Buy green electricity - GreenSource	Portland General Electric	https://www.portlandgeneral.com/residential/power-choices/renewable-power/green-source
Live in a smaller house or apartment	Oregon DEQ	http://www.oregon.gov/deq/mm/Pages/Green-Building.aspx
Look for the ENERGY STAR label when upgrading home appliances	ENERGY STAR	https://www.energystar.gov/products https://www.portlandgeneral.com/residential/energy-savings/appliances-electronics
Wash clothes in cold water	OSU Extension	http://extension.oregonstate.edu/malheur/sites/default/files/conservewaterclothes-em8358-e.pdf
If you own your home...		
Insulate and weatherize your home	Energy Trust of Oregon	https://www.energytrust.org/solutions/insulation-and-air-sealing/
When reroofing, choose a lighter color or reflective roof	Global Cool Cities Alliance	https://www.coolrooftoolkit.org/wp-content/pdfs/CoolRoofToolkit_Full.pdf
Switch from natural gas or propane heat to electric heat pumps	Union of Concerned Scientists	http://www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels/environmental-impacts-of-natural-gas#.WfzNwbaZOEI
Participate in Demand Response Programs	PGE	https://www.portlandgeneral.com/residential/energy-savings/special-offers-incentives

Table 9. *Building energy and efficiency - Organizational actions and resources*

Actions to take	Organizational resource	Links to learn more
Buy green power -- Go GreenSource	Portland General Electric	https://www.portlandgeneral.com/business/power-choices-pricing/renewable-power/choose-renewable

Buy offset natural gas via the Smart Energy Program	NWN	
Employ lean management strategies to reduce energy usage	University of Portland	http://www.biz-pi.com/lean-and-six-sigma-training-at-university-of-portland/
Get a building energy audit and evaluate conservation opportunities	Energy Trust of Oregon	https://www.energytrust.org/commercial/
Switch from natural gas or propane heat to electric heat pumps		
Insulate and weatherize for hot or cool seasons	Energy Trust of Oregon	https://www.energytrust.org/solutions/insulation-and-air-sealing/
Upgrade lighting and install occupancy sensors or timers	City of Portland	https://www.energytrust.org/incentives/existing-buildings-lighting/
When reroofing, choose cool or reflective roof	Global Cool Cities Alliance	https://www.coolrooftoolkit.org/wp-content/pdfs/CoolRoofToolkit_Full.pdf
Purchase ENERGY STAR certified appliances	ENERGY STAR	https://www.energystar.gov/products
Install smart power strips at workstations with three or more peripherals	Portland General Electric	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwj7zJDInqPXAhVT92MKHTgOCcQFggpMAA&url=https%3A%2F%2Fwww.portlandgeneral.com%2F-%2Fmedia%2Fpublic%2Fbusiness%2Fcontrol-my-energy-costs%2Fdocuments%2Fquick-tips.pdf%3Fla%3Den&usg=AOvVaw2yXE_AXt9h8iTww6aizQym
Install solar	Energy Trust of Oregon	https://www.energytrust.org/incentives/solar-for-your-business/

4b. Vehicle fleets and fuels

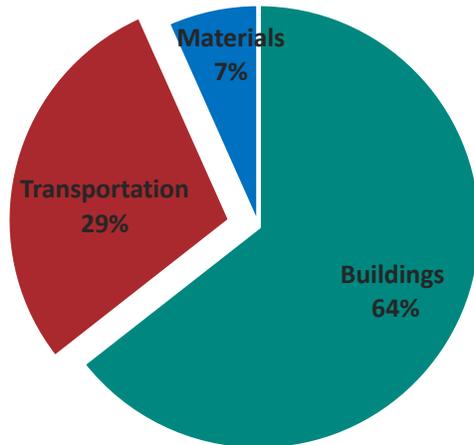


This chapter discusses strategies for reducing emissions from the vehicles we use to travel around our community for work, play or errands. Transportation systems such as bike lanes and mass transit are covered in Land Use and Transportation Planning, the next chapter.

Why it matters

We get around and move goods in our community in many different ways: by car, bus, motorcycle and more. Emissions from all these modes add up to 29% of Milwaukie’s carbon footprint (Figure 22).

Figure 22. Transportation proportion of all sector-based emissions in Milwaukie



Powered vehicles can be run on electricity or fuels. Fuels generally are most greenhouse gas intensive but are currently the most common. That said, there are low carbon fuels that can make large reductions in those emissions including biodiesel and renewable diesel – especially from used cooking oil, renewable natural gas from wastewater and dairy farm digesters, and other fuels such as cellulosic ethanol made from agricultural waste as they become available in the area.

Always consider biking or transit, but when you must drive, an electric vehicle is absolutely the best option, especially if powered with low carbon or renewable power. For heavy duty vehicles, there are many choices for lower carbon alternatives, but the market is more dynamic,

Vehicle fleets and fuels-related policies and plans

Milwaukie Comprehensive Plan

Milwaukie Transportation System Plan

Clackamas County Sustainability Policy

PGE Integrated Resource Plan

Oregon 10-year Energy Plan

Oregon Statewide Planning Goals

Oregon Clean Fuels Program

Federal Corporate Average Fuel Economy (CAFE) standards

meaning the power trains range from compressed natural gas, to propane, to renewable and bio–diesel (made from low carbon feedstocks) to battery electric and fuel cell electric trucks.

City-level strategies and actions

Prioritized City-level mitigation strategies

Table 10 presents the strategies and actions prioritized through the climate action planning process related to vehicle fleets and fuels. The table summarizes the City’s role in each action, the approximate timescale for implementation, relative levels of greenhouse gas reductions, and the net cost or savings per MT CO_{2e} reduced (this cost/savings is assumed by the lead implementer of the action). The table also shows the results of the project team’s co-benefits analysis.

Table 10. Vehicle fleets and fuels – City-level mitigation strategies

MITIGATION STRATEGIES

Vehicle Fleets and Fuels

Action	How will this be implemented?	When will the action be completed?	Potential GHG reductions	Cost/savings per MTCO ₂ e reduced	Co-benefits
Incentivize workplace electric vehicle charging in parking lots	L E	Short term	Medium	\$	3 high, 2 medium, 1 low
Support outreach efforts to encourage shift to electric vehicles	E	Short term	Medium	\$\$	3 high, 2 medium, 1 low
Create program to install electric vehicle charging infrastructure at multi-family complexes	L E	Short term	Low	\$	3 high, 2 medium, 1 low
Convert diesel-powered heavy fleet vehicles to low carbon fuels	O	Short term	Low	\$\$	3 high, 2 medium, 1 low
Optimize light duty fleet and replace least efficient vehicles with most efficient vehicles	O	Short term	Low	\$\$	3 high, 2 medium, 1 low
Work with Clackamas County, Tri-Met and Metro to develop micro-transit from park-and-ride or light rail station to local destinations	P	Short term	Not scalable	Not scalable	3 high, 2 medium, 1 low
Work with school district, waste haulers and waste water agency on fleet transition	P	Short term	Data unavailable	Data unavailable	3 high, 2 medium, 1 low

IN PROGRESS

- O City operations
- L City law/code
- E City educates
- C City partners for collective action
- P Partners lead, City participates
- SF City partners to lobby state/feds
- ✔ Addresses Milwaukee's superactions
- ⚖ Opportunity for social equity
- Mitigates and adapts in one action
- \$ Revenue generation of cost avoidance
- 👥 Leverages existing efforts
- 👍 Community support
- Short term
- Mid term
- Long term
- \$ net savings
- \$ net expenditure
- 3 high
- 2 medium
- 1 low

Plan to Action! Ways Milwaukie can get to work

EV “Electric Avenue”: PGE and the City of Milwaukie are partnering on the development of a new electric avenue EV charging hub in downtown Milwaukie. The newest Electric Avenue will be on Highway 99E, between SE Jackson and Monroe Streets, a location strategically selected for its high use and visibility to expand access to and awareness of the benefits of driving electric. With six ports, charging options will be available for any type of EV.



Prioritized City-level adaptation strategies

The City of Milwaukie must also act to plan for future physical conditions to ensure safety and ongoing service to the community. The strategies in Table 11 will help Milwaukie prepare its fleet and fuel storage for climate change.

Table 11. Vehicle fleets and fuels – City-level adaptation strategies

ADAPTATION STRATEGIES			
Vehicle Fleets and Fuels			
Action	How will this be implemented?	When will the action be completed?	Co-benefits
Review location of fleet yard and fuel storage to examine flood vulnerability. Look at fuel movement during flood conditions and diversify fuel sources in terms of fuel transport into Milwaukie to prepare for climate event-related import challenges.	○	➤➤➤	3 — 2 — 1 —
Implement intergovernmental agreements or MOUs with other agencies for fleet support in emergencies (e.g. large-scale debris removal)	○	➤➤➤	3 — 2 — 1 —

IN PROGRESS

○ City operations
 L City law/code
 E City educates
 C City partners for collective action
 P Partners lead, City participates
 SF City partners to lobby state/feds
✔ Addresses Milwaukie's superactions
 ⚖️ Opportunity for social equity
 ➤➤ Mitigates and adapts in one action
 \$ Revenue generation of cost avoidance
 👥 Leverages existing efforts
 👍 Community support

➤➤➤ Short term 3 high
➤➤ Mid term 2 medium
➤ Long term 1 low

Emissions reductions over time from prioritized actions

Table 12 shows the expected emissions reductions by 2035 if these actions are implemented.

Table 12. Projected emissions reductions from City-level actions and strategies

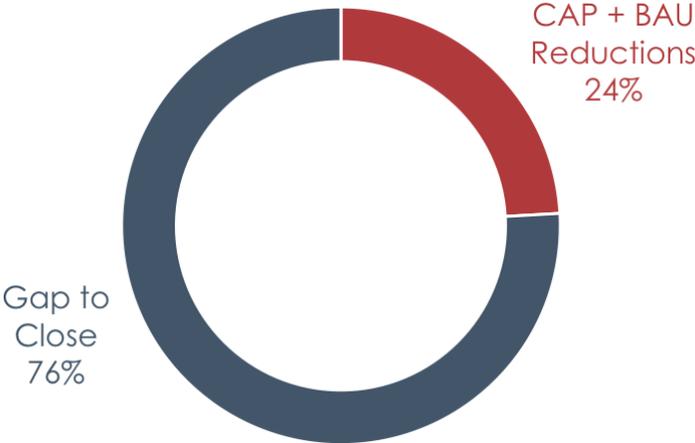
	2021	2023	2025	2027	2029	2031	2033	2035
Reductions from prioritized City-level strategies in the Climate Action Plan (MT CO ₂ e)	310	571	1,643	2,714	3,786	4,857	5,929	7,000
Reductions from BAU* existing policies (MT CO ₂ e)	1,375	2,750	4,125	5,500	6,875	8,250	9,625	11,000
Total reduction (BAU + Climate Action Plan) (MT CO ₂ e)	1,685	3,321	5,768	8,214	10,661	13,107	15,554	18,000
Percent reduction of 2016 emissions from fleets and fuels	2%	4%	8%	11%	14%	18%	21%	24%

*BAU = business as usual. These numbers are estimates for greenhouse gas reductions if technical potential is met and existing regional, state and federal policies are implemented.

Mind the gap: How much more do we have to do?

The City-level strategies in this plan and the actions already planned through existing policies at the local, state and federal level result in a 24% reduction in total sector-based greenhouse gas emissions related to vehicle fleets and fuels (Figure 23). *Note: this does not include emissions from household or corporate consumption.* **This leaves a gap of 76% to get to carbon neutral from fleets and fuels emissions.** To close this gap, Milwaukie households, businesses and other organizations must also take swift action.

Figure 23. Reduction in 2016 greenhouse gas emissions from vehicle fleets and fuels City-level strategies and existing policies



Closing the gap: Household and organizational actions

The following figures provide ideas for ways organizations, households and businesses can take action and help us close the gap and reach our goals.

[NOTE: These tables will be replaced in the final CAP with infographics. Please share your thoughts and ideas on additional resources to highlight on these tables]

Table 13. Vehicle fleets and fuels - Household actions and resources

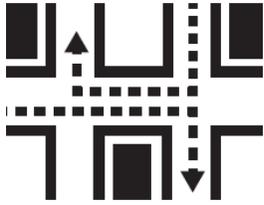
Actions to take	Organizational resource	Links to learn more
Reduce air travel	Drawdown	http://www.drawdown.org/solutions
Buy carbon credits to offset air travel	Terrapass	https://www.terrapass.com/product-category/individuals
If buying or leasing a new car consider an electric, hybrid or high mileage choice	Forth	https://forthmobility.org
Telecommute	Drive Less. Save More.	http://www.drivelesssave.com
Bike, walk, carpool or take public transit to work	TriMet & Metro	https://www.oregonmetro.gov/tools-living/getting-around
Consider ridesharing opportunities rather than owning a car if they are carbon neutral, electric or hybrid	Lyft & Uber	https://www.oregonmetro.gov/tools-living/getting-around/share-ride

Table 14. Vehicle fleets and fuels - Organizational actions and resources

Actions to take	Organizational resource	Links to learn more
If buying or leasing a new vehicle for your fleet consider an electric, hybrid or high mileage vehicle	Forth	https://forthmobility.org
Use telecommuting and video conferencing when possible		
Provide incentives for employees who choose to commute by public transit, alternative transportation or carpooling.	Drive Less	http://www.drivelessconnect.com
Provide parking for bicycles		
Offset air travel	Terrapass	https://www.terrapass.com/product-category/individuals

Install electric vehicle charging stations for customers and employees with credit card swipe	Portland General Electric	https://www.portlandgeneral.com/residential/electric-vehicles-charging-stations
Promote a "no idling" policy with your motor fleet and vendors who deliver goods and services.	U.S. Department of Energy	https://energy.gov/eere/vehicles/national-idling-reduction-network-news

4c. Land use and transportation planning

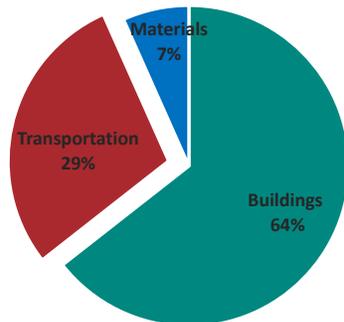


This chapter discusses land use, zoning and transportation planning efforts that could make our urban form more sustainable and make it easier for people to choose the mode of transportation that works for them the best.

Why it matters

Transportation emissions amount to 29% of the total community carbon footprint (Figure 24). Generally, a well-planned community allows people to live and get to their essential needs and services within a 20-minute walk. Also, zoning sets the stage for denser housing, which often reduces the size of dwellings, leading to less consumption of energy and goods. Essentially, a densely planned city with a strong transportation network allows for a more efficient society and more efficient use of household funds.

Figure 24. Transportation proportion of all sector-based emissions in Milwaukie



City-level strategies and actions

Prioritized City-level mitigation strategies

Table 15 presents the strategies and actions prioritized through the climate action planning process related to land use and transportation planning. The table summarizes the City’s role in each action, the approximate timescale for implementation, relative levels of greenhouse gas reductions, and the net cost or savings per MT CO_{2e} reduced (this cost/savings is assumed by the lead implementer of the action). The table also shows the results of the project team’s co-benefits analysis.

Land use and transportation-related plans and policies

- Milwaukie Community Vision
- Milwaukie Comprehensive Plan
- Central Milwaukie Land Use and Transportation Plan
- Milwaukie Downtown and Riverfront Land Use Framework Plan
- Milwaukie Transportation System Plan
- Milwaukie Water, Wastewater and Stormwater master plans
- Milwaukie-specific park plans
- Clackamas County Sustainability Policy
- Clackamas County Natural Hazards Mitigation Plan
- PGE Integrated Resource Plan
- Metro Climate Smart Strategy
- Oregon Biennial Energy Plan
- Oregon 10-year Energy Plan
- Oregon Statewide Planning Goals
- Oregon Greenhouse Gas Goals

Table 15. Land use and transportation planning – City-level mitigation strategies

MITIGATION STRATEGIES

Land Use and Transportation Planning

Action	How will this be implemented?	When will the action be completed?	Potential GHG reductions	Cost/savings per MTCO ₂ e reduced	Co-benefits	
IN PROGRESS	Implement the Safe Access for Everyone (SAFE) street and sidewalk improvement program to expand bike and pedestrian access	O C		Emissions already incorporated into BAU forecast		
	Partner with Metro and TriMet to increase transit service, particularly to underserved employment areas	C			\$\$	
	Implement a Transportation Management Agency (TMA) with area partners	C			\$\$	
	Implement "EV ready" zoning regulations that affect buildings and multifamily housing	L E			Data unavailable	
	Incentivize employers to encourage active transportation and transit	E C			\$\$	
	IN PROGRESS	Continue to promote a "fee in lieu of" for areas outside of pedestrian corridors; redirect funds to corridors that do	L			\$\$

O City operations	L City law/code	E City educates	C City partners for collective action	P Partners lead, City participates	SF City partners to lobby state/feds			3 high
Addresses Milwaukee's superactions	Opportunity for social equity	Mitigates and adapts in one action	Revenue generation of cost avoidance	Leverages existing efforts	Community support		net expenditure	2 medium
								1 low

MITIGATION STRATEGIES

Land Use and Transportation Planning (continued)

Action	How will this be implemented?	When will the action be completed?	Potential GHG reductions	Cost/savings per MTCO ₂ e reduced	Co-benefits
IN PROGRESS Promote "neighborhood hubs" through Comprehensive Plan policies	L	»»»	■ ■ ■ ■ ■	\$\$	3 — 2 — 1 —
IN PROGRESS Implement parking pricing in downtown	L	»»»	■ ■ ■ ■ ■	Data unavailable	3 — 2 — 1 —
Implement variable system development charges to encourage accessory dwelling unit development	L	»»»	■ ■ ■ ■ ■	\$\$\$\$	3 — 2 — 1 —
Lower parking ratios near high capacity corridors	L	»»»	Data unavailable	Data unavailable	3 — 2 — 1 —

City operations	City law/code	City educates	City partners for collective action	Partners lead, City participates	City partners to lobby state/feds	Short term	\$ net savings	3 high
Addresses Milwaukee's superactions	Opportunity for social equity	Mitigates and adapts in one action	Revenue generation of cost avoidance	Leverages existing efforts	Community support	Mid term	\$ net expenditure	2 medium
						Long term		1 low

Note on the SAFE program: Mitigation scaling for the SAFE program is accounted for in a number of transportation related actions in the analysis including: Work with partner agencies to address bike and pedestrian gaps; Incentivize employers to encourage active transport; and Promote "neighborhood hubs. Emissions reductions from this strategy are also accounted for in Metro's Climate Smart Strategy, which is included in the BAU reduction estimate.



Plan to Action! Ways Milwaukie can get to work

Neighborhood hubs: As part of its current update to Milwaukie's Comprehensive Plan, the City is currently exploring options for how to make the neighborhood hub vision a reality. Neighborhood hubs are intended to provide neighborhood gathering places and locations where residents have access to a variety of services or goods within walking or biking distance of their homes. Hubs are envisioned to vary in size and intensity. They could be as small as a mobile neighborhood tool library (tool sharing) or as large as a cluster of mixed use buildings with housing above shops and services. [Learn more on the City's website.](#)



Hub Example: Community Bicycle Repair Shed

Source: www.communitycyclingcenter.org



Hub Example: Small Cafe with Outdoor Seating

Source: www.timeout.com

Prioritized City-level adaptation strategies

The City of Milwaukie must also act to plan for future physical conditions to ensure safety and ongoing service to the community. The strategies in table 16 will help Milwaukie prepare for climate change from a land use perspective.

Table 16. Land use and transportation planning – City-level adaptation strategies
ADAPTATION STRATEGIES

Land Use and Transportation Planning

Action	How will this be implemented?	When will the action be completed?	Co-benefits
Update flood plain maps with local group coordination and funding	O	>>>	
Provide incentives to increase flood storage capacity	L	>>>	
Reclaim riparian areas for flood storage for safety and property protection	O	>>>	
Plan for future employment land considering flood risk and natural resources	L	>>>	

City operations	City law/code	City educates	City partners for collective action	Partners lead, City participates	City partners to lobby state/feds	Short term	3 high
Addresses Milwaukee's superactions	Opportunity for social equity	Mitigates and adapts in one action	Revenue generation of cost avoidance	Leverages existing efforts	Community support	Mid term	2 medium
						Long term	1 low

Emissions reductions over time from prioritized actions

Table 17 shows the expected emissions reductions by 2035 if these actions are implemented.

Table 17. Projected emissions reductions from City-level actions and strategies

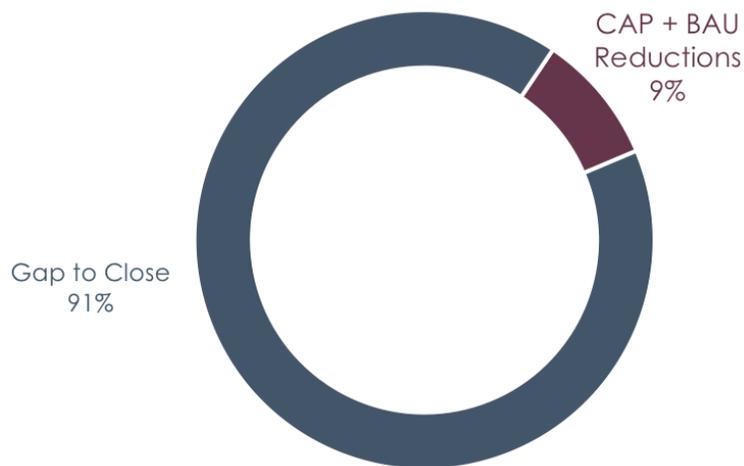
	2021	2023	2025	2027	2029	2031	2033	2035
Reductions from prioritized City-level strategies in the Climate Action Plan (MT CO₂e)	0	443	2,969	5,495	8,021	10,548	13,074	15,600
Reductions from BAU* existing policies (MT CO₂e)	0	0	0	0	0	0	0	0
Total reduction (BAU + Climate Action Plan) (MT CO₂e)	0	443	2,969	5,495	8,021	10,548	13,074	15,600
Percent reduction of 2016 emissions	0%	1%	2%	3%	5%	6%	8%	9%

*BAU = business as usual. These numbers are estimates for greenhouse gas reductions if technical potential is met and existing regional, state and federal policies are implemented.

Mind the gap: How much more do we have to do?

The City-level strategies in this plan and the actions already planned through existing policies at the local, state and federal level result in a 9% reduction in total sector-based greenhouse gas emissions related to transportation (Figure 25). This is additional to the 24% emissions reductions from vehicle fleets and fuels strategies. The total reduction of all transportation related actions adds up to 33% of Milwaukie’s sector-based transportation emissions (represented in this chapter and the vehicle fleets and fuels chapter). *Note: this does not include emissions from household or corporate consumption.* **Looking just at the land use and transportation component, this leaves a gap of 91% to get to carbon neutral.** To close this gap, Milwaukie households, businesses and other organizations must also take swift action.

Figure 25. Reduction in 2016 greenhouse gas emissions from land use and transportation planning City-level strategies and existing policies



Closing the gap: Household and organizational actions

The following figures provide ideas for ways organizations, households and businesses can take action and help us close the gap and reach our goals.

[NOTE: These tables will be replaced in the final CAP with infographics. Please share your thoughts and ideas on additional resources to highlight on these tables]

Table 18. Land use and transportation - Household actions and resources

Actions to take	Organizational resource	Links to learn more
Live close to work or public transit that gets you to work and your daily necessities	Metro	https://www.oregonmetro.gov/tools-living/getting-around
Live in a smaller house or apartment	Oregon DEQ	http://www.oregon.gov/deq/mm/Pages/Green-Building.aspx

If you own your own home		
Develop an accessory dwelling unit on your property for family or rental income	City of Milwaukie	

Table 19. Land use and transportation planning - Organizational actions and resources

Actions to take	Organizational resource	Links to learn more
If you are a commercial business, locate your business near your customers or near to their transit connections		
If you are a manufacturer, distributor or office-based business, locate near where your workforce lives or near to their transit connections		
Charge for workplace parking		
Check to see if your property is exposed to flood or wildfire risk		

4d. Materials use, purchasing and recovery

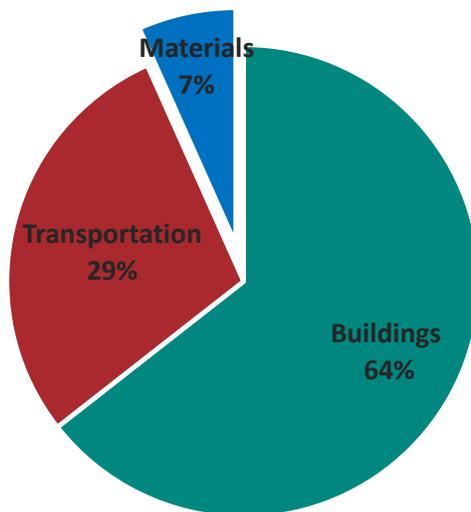


This chapter explores strategies and actions for reducing emissions related to the things we buy and use such as goods, food and the major materials of regular life.

Why it matters

In Milwaukie, materials and goods make up 7% of our community’s local carbon footprint (Figure 26). However, when we buy goods, materials and food, we are also causing greenhouse gas emissions to be created from the production of those materials elsewhere. When we import these goods from places other than our own community we are also “importing” the emissions. These emissions represent nearly double the amount of emissions we produce here in Milwaukie in total (sector-based or “local” emissions). If those could be accounted without overlap the materials slice of the pie in Figure 27, would be approximately 49%.

Figure 26. Materials proportion of all sector-based emissions in Milwaukie



Materials-related plans and policies

Milwaukie Community Vision

Milwaukie Comprehensive Plan

Central Milwaukie Land Use and Transportation Plan

Clackamas County Sustainability Policy

Oregon DEQ Materials Management Vision

Oregon Biennial Energy Plan

Oregon 10-year Energy Plan

Oregon Greenhouse Gas Goals

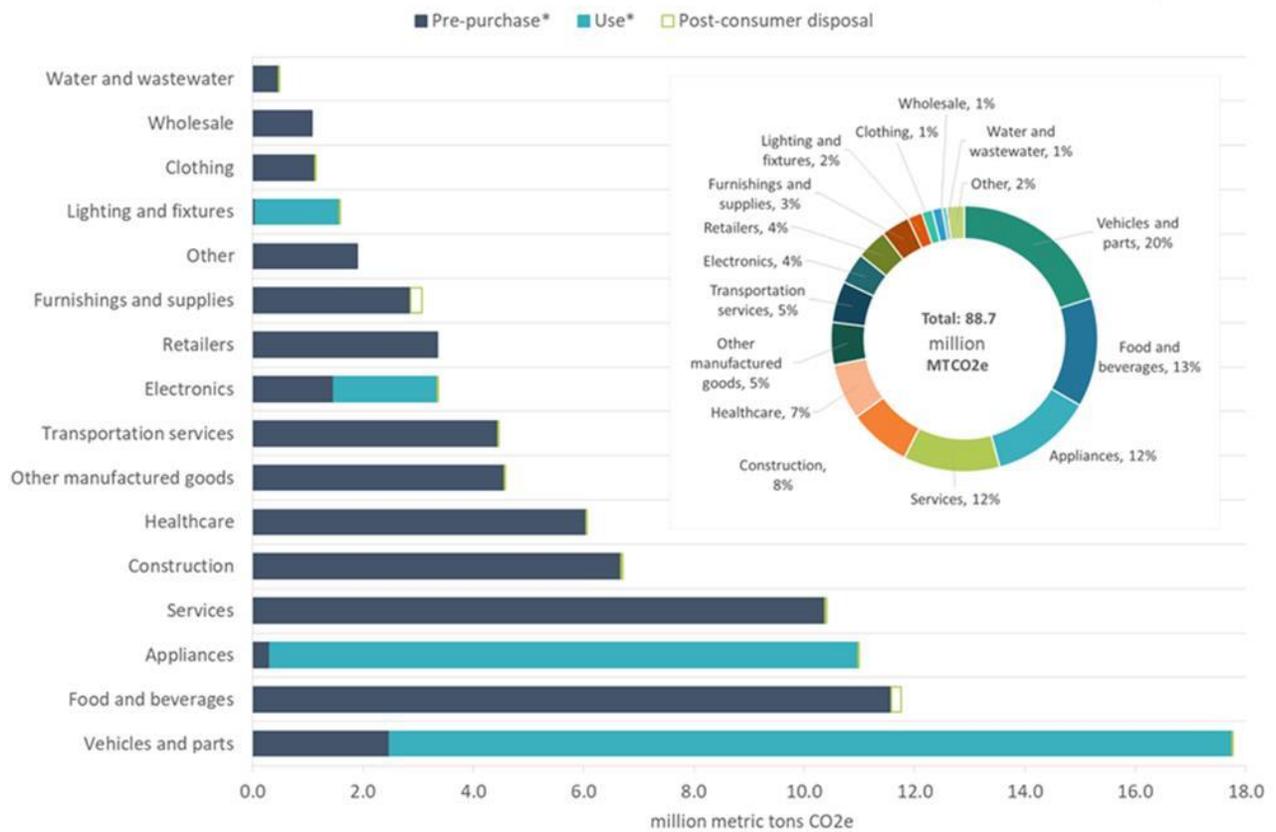
Oregon Senate Bill 263 Recovery Goals

While we can estimate household imported emissions from consumption, we cannot yet accurately estimate the emissions coming from organizational consumption – such as businesses and non-profits due to the proprietary nature of that data, as well as no existing reason for that to be gathered previously by governments. The Oregon Department of

Environmental Quality estimates that 80% of total GHG emissions in Oregon come from household demand, while governments and businesses are 10% each (<https://www.oregon.gov/DEQ/mm/Pages/Consumption-based-GHG.aspx>).

For most materials, the greatest amount of emissions are released during pre-purchase and production (Figure 27). Overall, emissions at the “disposal” phase are minimal, meaning recycling alone may not have a significant impact. Therefore, it is essential for us all to buy less, buy used, buy goods made with recycled material, buy durable, buy energy-efficient, and buy lower carbon. Once we have materials, we need to consider fixing before buying new or disposal, giving or selling unwanted goods to others, and recycling as much as possible. In short – **reduce, reuse, recycle**.

Figure 27. Oregon consumption-based greenhouse gas emissions by category and life cycle stage – Oregon DEQ, 2015



* "Pre-purchase" are all emissions that occur prior to final purchase, including production, supply chain, transport, retail and wholesale. "Use" refers to emissions resulting from the use of vehicles, appliances, electronics and lighting. Other categories (e.g., food and clothing) have use phase emissions that are accounted for elsewhere. For example, emissions from cooking and laundering are both assigned to the category of "appliances", which include ranges and clothes dryers.

One of the greatest places for action is reducing food waste and considering the carbon footprints of the types of food we consume. The average American household wastes more than a fifth of all the milk, meat, grains, seafood, and fruits and vegetables they buy (Figure 28).

When considering which types of foods we should consume, meat and dairy products tend to have a much higher carbon foot print than other food options (Figure 29).

Figure 28. Proportion of food wasted by average American households – NRDC, 2017

What gets wasted?

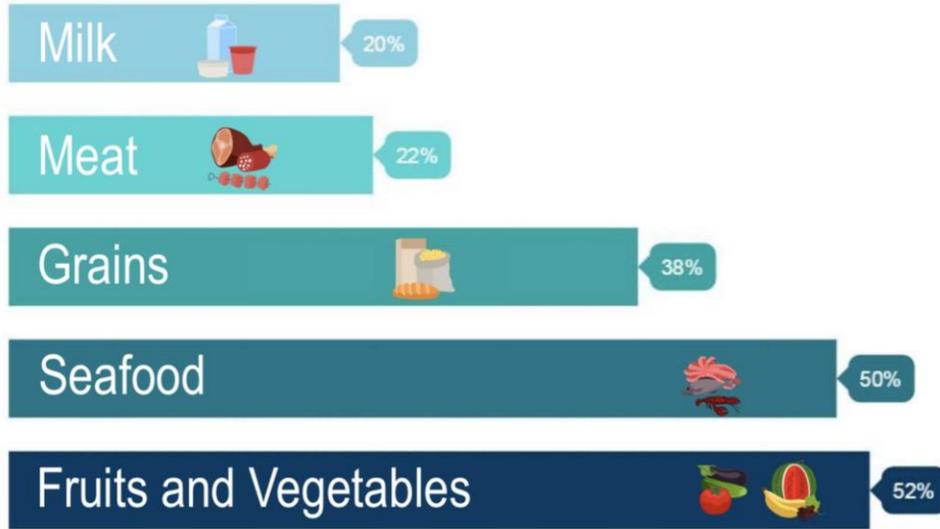
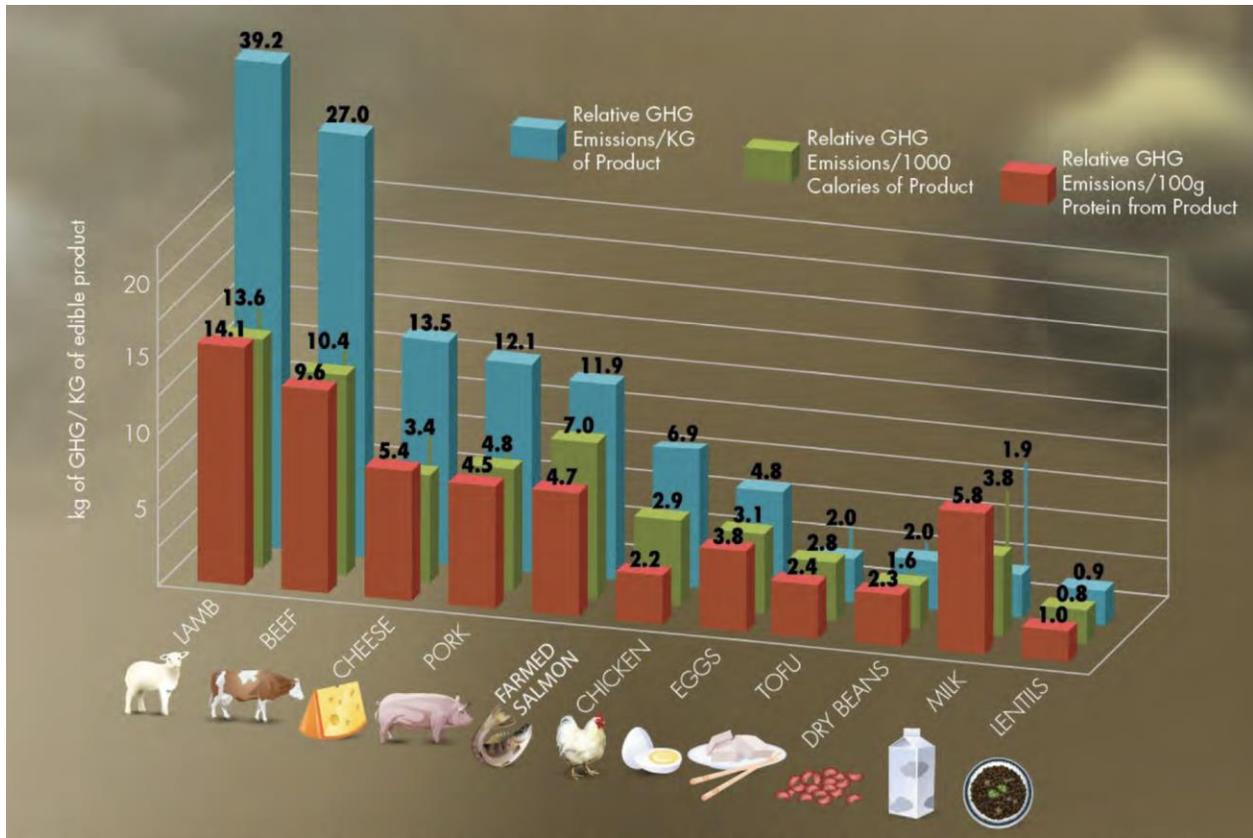


Figure 29. Emissions from different food sources – Menus of Change, 2017



City-level strategies and actions

Prioritized City-level mitigation strategies

Table 20 presents the strategies and actions prioritized through the climate action planning process related to materials use, purchasing and recovery. The table summarizes the City's role in each action, the approximate timescale for implementation, relative levels of greenhouse gas reductions, and the net cost or savings per MT CO₂e reduced (this cost/savings is assumed by the lead implementer of the action). The table also shows the results of the project team's co-benefits analysis.

Table 20. Materials use, purchasing and recovery – City-level mitigation strategies

MITIGATION STRATEGIES

Materials – Purchasing, Use and Recovery

Action	How will this be implemented?	When will the action be completed?	Potential GHG reductions	Cost/savings per MTCO ₂ e reduced	Co-benefits
City to require deconstruction or delayed demolition period	L	Short term	High	Net expenditure (\$\$)	Addresses Milwaukee's superactions, Opportunity for social equity, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Promote the repair of equipment and materials and buy used and durable before purchasing new	E C	Short term	High	Net savings (\$\$)	Addresses Milwaukee's superactions, Opportunity for social equity, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Provide education and outreach to avoid edible food waste	E C P	Short term	High	Net savings (\$\$\$\$)	Addresses Milwaukee's superactions, Opportunity for social equity, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Public Works to use less impactful pavement alternatives	O	Short term	High	Net expenditure (\$)	Addresses Milwaukee's superactions, Opportunity for social equity, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Promote existing food waste composting services	E P	Short term	High	Net savings (\$\$)	Addresses Milwaukee's superactions, Opportunity for social equity, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Use mulch and compost in landscaping	O	Short term	High	Net savings (\$\$)	Addresses Milwaukee's superactions, Opportunity for social equity, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Showcase materials management practices with a demonstration project	E	Short term	Not scalable	Not scalable	Addresses Milwaukee's superactions, Opportunity for social equity, Revenue generation of cost avoidance, Leverages existing efforts, Community support

City operations	City law/code	City educates	City partners for collective action	Partners lead, City participates	City partners to lobby state/feds	Short term	net savings	3 high
Addresses Milwaukee's superactions	Opportunity for social equity	Mitigates and adapts in one action	Revenue generation of cost avoidance	Leverages existing efforts	Community support	Mid term	net expenditure	2 medium
						Long term		1 low

Plan to Action! Ways Milwaukie can get to work

Building deconstruction: Deconstruction refers to carefully dismantling structures in order to re-use, repurpose or recycle its materials. It differs from demolition, where a site is cleared as quickly as possible and materials are often discarded. Deconstruction allows the embodied energy of one structure's materials to be repurposed into a new structure or item, reducing the need for new material production. Deconstruction also protects public health and creates economic opportunity.

The City of Portland requires projects seeking a demolition permit of a house or duplex to fully deconstruct the structure if it was built in 1916 or earlier or is a designated historic resource. Milwaukie could follow suit with its own ordinance requiring deconstruction or delayed demolition.



Photo credit: City of Portland

Emissions reductions over time from prioritized actions

Table 21 shows the expected emissions reductions by 2035 if these actions are implemented.

Table 21. Projected emissions reductions from City-level actions and strategies

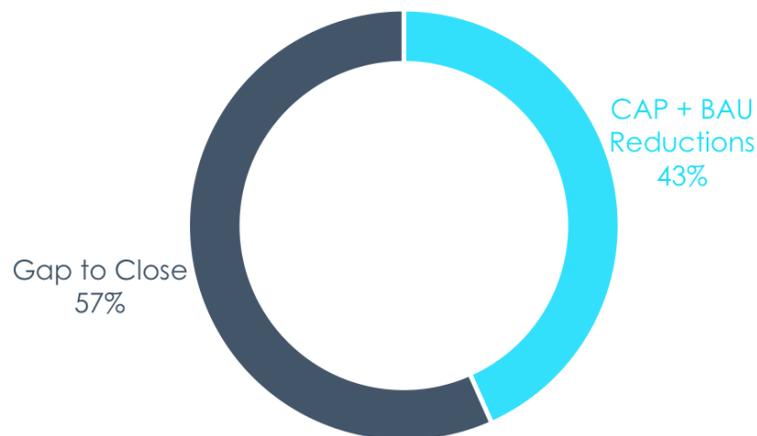
	2021	2023	2025	2027	2029	2031	2033	2035
Reductions from prioritized City-level strategies in the Climate Action Plan (MT CO ₂ e)	0	257	748	1,238	1,729	2,219	2,710	3,200
Reductions from BAU* existing policies (MT CO ₂ e)	125	250	375	500	625	750	875	1,000
Total reduction (BAU + Climate Action Plan) (MT CO ₂ e)	125	507	1,123	1,738	2,354	2,969	3,585	4,200
Percent reduction of 2016 emissions from materials-related emissions	1%	6%	12%	19%	26%	33%	40%	43%

*BAU = business as usual. These numbers are estimates for greenhouse gas reductions if technical potential is met and existing regional, state and federal policies are implemented.

Mind the gap: How much more do we have to do?

The City-level strategies in this plan and the actions already planned through existing policies at the local, state and federal level result in a 43% reduction in total sector-based greenhouse gas emissions related to materials use, purchasing and recovery (Figure 30). *Note: this does not include emissions from household or corporate consumption. This leaves a gap of 57% to get to carbon neutral from materials-related emissions.* To close this gap, Milwaukie households, businesses and other organizations must also take swift action.

Figure 30. Reduction in 2016 greenhouse gas emissions from materials use, purchasing and recovery City-level strategies and existing policies



Closing the gap: Household and organizational actions

The following Figures provide ideas for ways organizations, households and businesses can take action and help us close the gap and reach our goals.

[NOTE: These tables will be replaced in the final CAP with infographics. Please share your thoughts and ideas on additional resources to highlight on these tables]

Table 22. *Materials use, purchasing and recovery - Household actions and resources*

Actions to take	Organizational resource	Links to learn more
Calculate your household carbon footprint	Oregon DEQ	https://www.oregon.gov/deq/Residential/Pages/Calculate-Your-Carbon-Footprint.aspx
Purchase carbon credits to offset your household impacts	Terrapass	https://www.terrapass.com/for-individuals/for-individualsustainable-living
Reduce food waste through meal planning	Clackamas County & Metro	eatsmartwasteless.com https://www.oregonmetro.gov/tools-working/reducing-food-waste
Eat a plant-rich diet	Drawdown	http://www.drawdown.org/solutions
Repair and reuse durable goods	Oregon DEQ & Clackamas County	https://repairfair.org/upcoming-repair-events https://www.clackamas.us/recycling/repairfair.html
Purchase used items and products with a high recycled content		
Sell, donate or recycle unwanted goods.	Habitat for Humanity Goodwill	https://www.habitat.org/restores http://www.goodwill.org/
Compost your food scraps and use in your landscape or put in the curbside bins for yard waste and food	Metro & Drawdown	https://www.oregonmetro.gov/tools-living/yard-and-garden/composting https://www.drawdown.org/solutions/food/composting

Table 23. *Materials use, purchasing and recovery - Organizational actions and resources*

Actions to take	Organizational resource	Links to learn more
Select major purchases based on total cost of ownership, not just upfront costs.		

Implement Lean Manufacturing to reduce material consumption and waste	Oregon Manufacturing Extension Partnership	
Fix anything before replacing it unless there is a big energy or material efficiency gain		
Consider purchasing durable, recycled content and used products and inputs	Oregon DEQ	http://www.oregon.gov/deq/mm/Pages/Product-Lifespan-Extension.aspx
Donate surplus electronics and furniture to charitable organizations	Goodwill FreeGeek	https://www.goodwillwa.org/donate/recycling-sustainability/
Compost commercial food waste, particularly if a food business	Clackamas County	https://www.clackamas.us/recycling/foodwaste/business.html
Use centralized printers that are defaulted to double sided	City of Portland	https://www.portlandoregon.gov/sustainabilityatwork/article/531036
Utilize paperless invoicing, billing and payroll to reduce paper use	City of Portland	https://www.portlandoregon.gov/sustainabilityatwork/article/531036

4e. Natural resources



This chapter addresses how we can plan for the impact of climate change on our natural resources, including the urban forest and Milwaukie's waterways.

Why it matters

Our community and all of its inhabitants have developed around the natural patterns of the systems all around us. Our trees have provided comfort, water absorption, soil retention, clean air and mental well-being for generations. With the climate changing, the trees we care for and plant will be challenged by more water in the winter and less water and more heat in the warm months. As our climate moves to a two-season year, we will have to select species that can provide all the benefits or “ecosystem services” that we all enjoy, but can withstand drought, heat and fire.

Our waterways are the arteries of the natural world and it is no different in our community. As we move to the two-season regime, we will need to deliberately manage our waterways for the health of our natural ecosystems as well as the health, safety and comfort of our residents. In the wet season, with the loss of snowpack, we will be getting more flow down our streams and rivers. The flooding that will occur from the increase in real time flow of precipitation will be exaggerated by the tidal stretch of the Willamette River and sea level rise. The dry season will challenge our water systems as temperatures rise (Figure 31). By 2040 we will see 30-50% reduction in summer flows that can leave people, animals and fish looking for cool refuge and may cause algal blooms that can harm human health.

Natural resources-related plans and policies

Milwaukie Community Vision

Milwaukie Comprehensive Plan

Central Milwaukie Land Use and Transportation Plan

Milwaukie Downtown and Riverfront Land Use Framework Plan

Milwaukie Water, Wastewater and Stormwater master plans

Milwaukie-specific park plans

Clackamas County Sustainability Policy

Clackamas County Natural Hazards Mitigation Plan

North Clackamas Parks and Recreation District North Side Master Plan

Regional Water Providers Consortium Strategic Plan

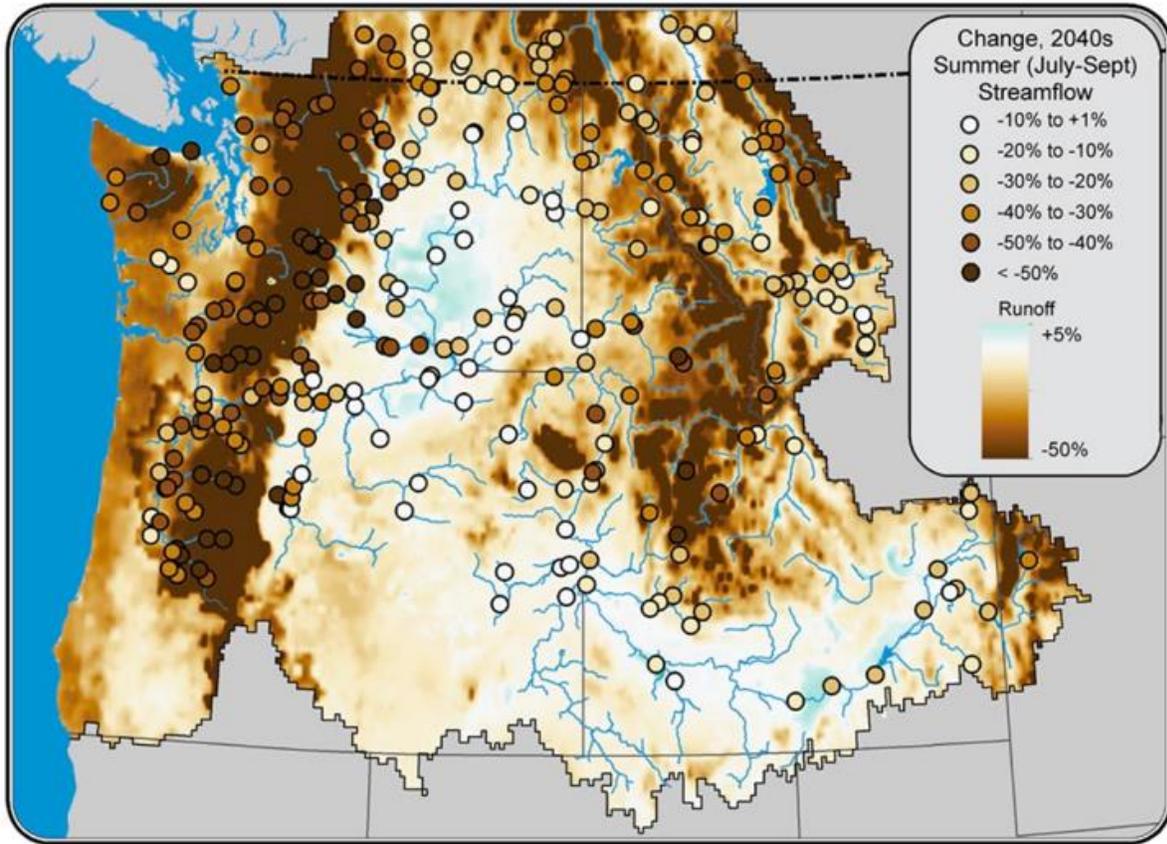
Oregon Biennial Energy Plan

Oregon 10-year Energy Plan

Oregon Statewide Planning Goals

Oregon Greenhouse Gas Goals

Figure 31. Change in summer streamflow by 2040 – National Climate Assessment, 2014



City-level strategies

Prioritized City-level actions

The table below presents the actions prioritized through the climate action planning process related to natural resources. It summarizes how the action will be implemented and the timescale for completion. Results of co-benefits analysis are also summarized for each action. Most of these actions are intended to plan for future physical conditions to ensure safety and ongoing service to the community. The action related to increasing our tree canopy to 40% by 2040—a goal of Milwaukee’s Tree Board and draft Urban Forest Plan—is considered a “sequestration” strategy that will enable us to sequester greenhouse gases even after we are carbon neutral in 2050.

Table 24. Natural resources – City-level adaptation and sequestration strategies

ADAPTATION STRATEGIES						
Natural Resources						
	Action	How will this be implemented?	When will the action be completed?	Potential GHG reductions	Cost/savings per MTCO ₂ e reduced	Co-benefits
IN PROGRESS	Work with the Tree Board to develop a tree planting program focused on shielding low income neighborhoods from heat	O L E	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —
IN PROGRESS	Review intergovernmental water agreements	O C	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —
IN PROGRESS	Identify sewer and waterways vulnerable to flooding	O C	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —
IN PROGRESS	Adjust code to require on-site stormwater storage and water filtration before release that meets future conditions	L	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —
IN PROGRESS	Update a new stormwater masterplan	O L	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —
IN PROGRESS	De-pave areas where possible to encourage stormwater infiltration	O	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —
IN PROGRESS	Introduce more monitoring stations to protect drinking water wells	O C	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —
IN PROGRESS	Develop a potable/drinkable water re-use plan	O C	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —

SEQUESTRATION STRATEGIES						
Natural Resources						
	Action	How will this be implemented?	When will the action be completed?	Potential GHG reductions	Cost/savings per MTCO ₂ e reduced	Co-benefits
IN PROGRESS	Increase tree canopy to 40% by 2040	O E C	»»»	■ ■ ■ ■ ■	\$	3 — 2 — 1 —

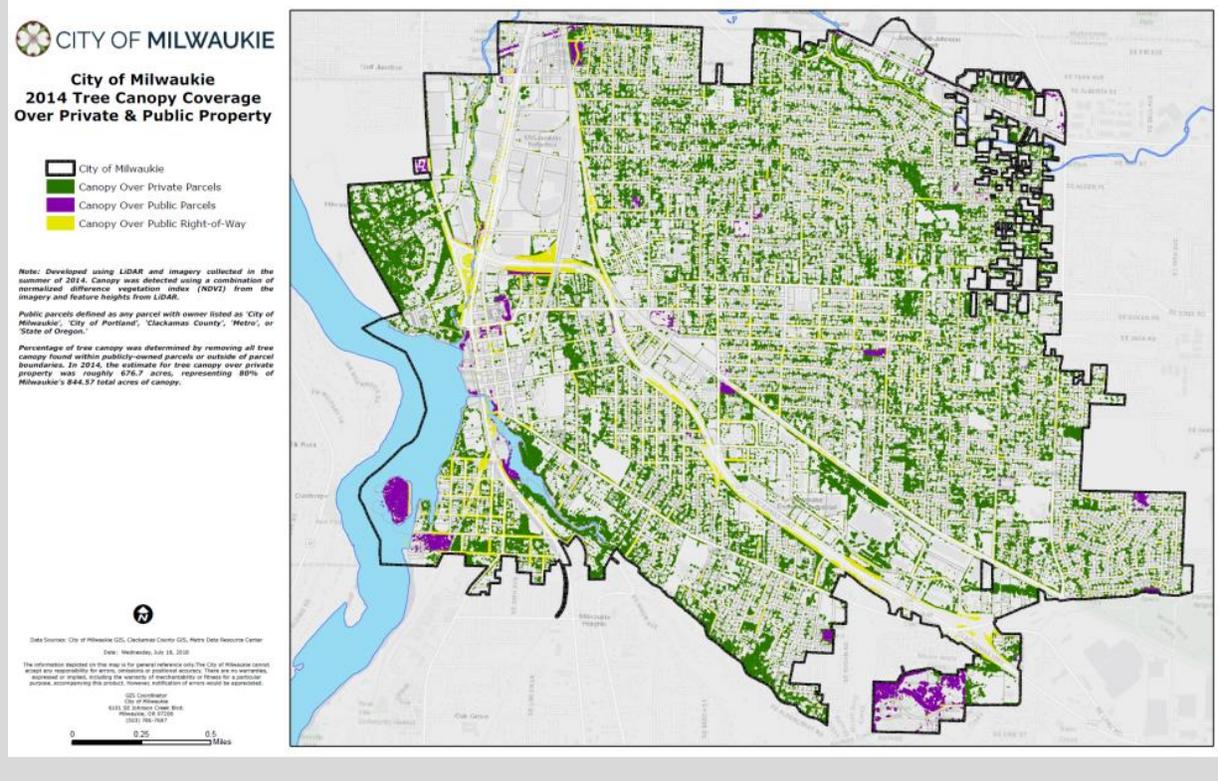
O City operations	L City law/code	E City educates	C City partners for collective action	P Partners lead, City participates	SF City partners to lobby state/feds	»»» Short term 3 high
Addresses Milwaukee's superactions	ATA Opportunity for social equity	»» Mitigates and adapts in one action	\$ Revenue generation of cost avoidance	»»» Leverages existing efforts	»»» Community support	»»» Mid term 2 medium
						»»» Long term 1 low

Plan to Action! Milwaukie already getting to work

Increasing our tree canopy: Trees make Milwaukie a special place to live, work and visit. Our urban forest helps reduce the amount of CO₂ in our atmosphere, conserve energy, capture stormwater run-off, and curb the impacts of flooding—increasingly important functions as our community plans for climate change.

Canopy cover refers to the percentage of ground area covered by trees, and evaluating it over time is necessary to understanding the state of our urban forest. A 2014 LiDAR assessment estimated Milwaukie's tree canopy coverage to be 26%. It also reveals many areas that can accommodate increased canopy coverage within the City. The City has set a goal of increasing our canopy coverage to 40% by 2040.

A new Urban Forest Plan and stronger tree ordinance developed in fall 2018 will help us reach this ambitious but achievable target by guiding new development responsibly and preventing harmful, unnecessary tree removal



Household and organizational actions

The following Figures provide ideas for ways organizations, households and businesses can take action and help us prepare for future climate conditions.

[NOTE: These tables will be replaced in the final CAP with infographics. Please share your thoughts and ideas on additional resources to highlight on these tables]

Table 25. Natural resources - Household actions and resources

Actions to take if you own your home	Organizational resource	Links to learn more
Plant trees in your yard to provide shade and cooling in summer heat. Select climate adapted trees.	Milwaukie Tree Board Friends of Trees	https://friendsoftrees.org/
Landscape with drought-resistant native or well adapted plants	Metro	https://www.oregonmetro.gov/tools-living/yard-and-garden/plants/native-plants
Proactive pruning of trees to reduce damage from ice storms	OSU Extension Milwaukie Tree Board	http://extension.oregonstate.edu/gardening/choosing-ice-storm-resistant-trees
De-pave areas wherever possible to encourage stormwater infiltration onsite	City of Milwaukie	https://depave.org/
Install bioswales/rain garden or rainwater catchment system to reduce impact on stormwater system	City Of Milwaukie	
Landscaping with drought-resistant native or well adapted plants	Metro	https://www.oregonmetro.gov/tools-living/yard-and-garden/plants/native-plants
Upgrade toilet, clothes washer and install low flow faucets and shower heads to reduce water consumption.	Regional Water Providers Consortium	https://www.regionalh2o.org/usin-g-water-efficiently-indoors

Table 26. Natural resources - Organizational actions and resources

Actions to take	Organizational resource	Links to learn more
Plant trees in around your building to provide shade and cooling in summer heat (far enough away to protect structures from fire but benefit from shade). Select climate adapted trees.	City of Milwaukie Friends of Trees	https://friendsoftrees.org/
Landscape with drought-resistant native or well adapted plants	Metro	https://www.oregonmetro.gov/tools-living/yard-and-garden/plants/native-plants
Proactive pruning of trees to reduce damage from ice storms	OSU Extension	http://extension.oregonstate.edu/gardening/choosing-ice-storm-resistant-trees

De-pave areas wherever possible to encourage stormwater infiltration onsite	City of Milwaukie	https://depave.org/
Install rainwater catchment or bio swales to reduce flooding	City of Milwaukie	
Upgrade toilet, clothes washer and install low flow faucets and shower heads.	Regional Water Providers Consortium	https://www.regionalh2o.org/using-water-efficiently-indoors

4f. Public health and emergency preparedness

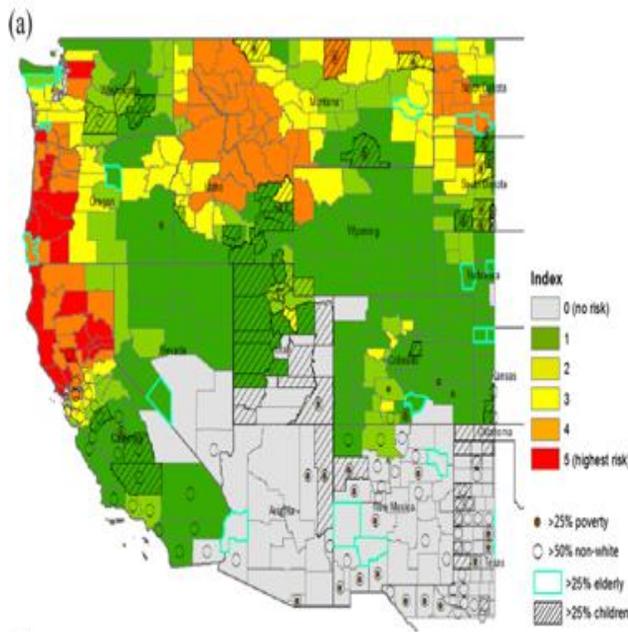


This chapter addresses strategies for keeping our community healthy and safe as we experience the impacts of climate change.

Why it matters

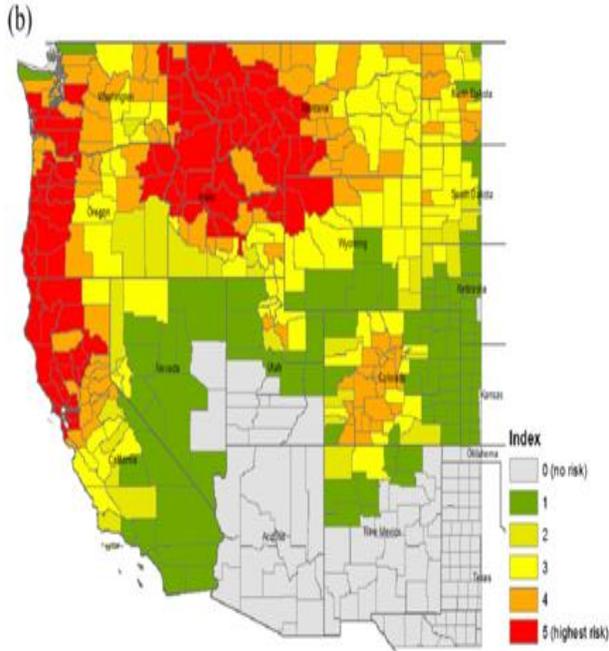
Acute climate events resulting from climate change include heat waves, increase wildfires in our region, decreased air quality, flooding risk and more (see chapter 3 for more information). For example, Figure 32 demonstrates the expected air quality impacts that will follow the increased wildfire in the Western States. By 2050, almost all of Oregon will experience high-risk levels of particulate air pollution from wildfires in the warmer months. These acute events must be addressed through a planned, coordinated response—being proactive and setting processes in place now will help us adapt and respond quickly when the time comes.

Figure 32. Particulate air pollution from wildfires in the western United States under climate change, (a) 2004-2009 to (b) 2046-2051 – Liu, 2016



Public health and emergency preparedness-related plans and policies

- Milwaukie Community Vision
- Milwaukie Comprehensive Plan
- Central Milwaukie Land Use and Transportation Plan
- Milwaukie Downtown and Riverfront Land Use Framework Plan
- Milwaukie Transportation System Plan
- Milwaukie Water, Wastewater and Stormwater master plans
- Milwaukie-specific park plans
- Clackamas County Sustainability Policy
- Clackamas County Natural Hazards Mitigation Plan
- Energy Trust Strategic Plan
- Metro Climate Smart Strategy
- Regional Water Providers Consortium
- Oregon Statewide Planning Goals
- Oregon Greenhouse Gas Goals



Climate change will also have chronic impacts on our community’s health and wellbeing. In addition to planning for acute events, we need to prepare for increased population, the potential for a rise in crime from increased and prolonged heat, mental health stress from more dramatic weather events, and the introduction of new diseases following insects (ticks and mosquitoes), people and animals that migrate north (Figure 33).

Figure 33. Climate change triggers and potential health and public safety impacts – Oregon Health Authority, Oregon Climate and Health Profile, 2014



City-level strategies

Prioritized City-level adaptation actions

The table below presents the adaptation actions prioritized through the climate action planning process related to public health and emergency preparedness. It summarizes how the action will be implemented and the timescale for completion. Results of co-benefits analysis are also summarized for each action. These actions are intended to plan for future physical conditions to ensure safety and ongoing service to the community.

Table 27. Public health and emergency preparedness – City-level adaptation strategies

ADAPTATION STRATEGIES

Public Health and Emergency Preparedness

Action	How will this be implemented?	When will the action be completed?	Co-benefits
Work with the Federal Emergency Management Agency (FEMA) to update flood plain maps	C	Short term	3 — Addresses Milwaukee's superactions, Opportunity for social equity, Mitigates and adapts in one action, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Work with partners to support community outreach about how to reduce fire and flood risk	E C	Short term	3 — Addresses Milwaukee's superactions, Opportunity for social equity, Mitigates and adapts in one action, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Plan for cooling and air quality relief centers	O C	Short term	3 — Addresses Milwaukee's superactions, Opportunity for social equity, Mitigates and adapts in one action, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Promote more sophisticated home air filtration systems	L E C	Short term	3 — Addresses Milwaukee's superactions, Opportunity for social equity, Mitigates and adapts in one action, Revenue generation of cost avoidance, Leverages existing efforts, Community support
Develop public-facing flood and fire risk zone maps and implement signage on streets to raise awareness	O C	Short term	3 — Addresses Milwaukee's superactions, Opportunity for social equity, Mitigates and adapts in one action, Revenue generation of cost avoidance, Leverages existing efforts, Community support

O City operations	L City law/code	E City educates	C City partners for collective action	P Partners lead, City participates	SF City partners to lobby state/feds	Short term 3 high
Addresses Milwaukee's superactions	Opportunity for social equity	Mitigates and adapts in one action	Revenue generation of cost avoidance	Leverages existing efforts	Community support	Mid term 2 medium
						Long term 1 low

Learn about community emergency preparedness and resiliency	Regional Water Providers Consortium	https://www.regionalh2o.org/emergency-preparedness
Attend Neighborhood District Associations meetings to learn from and educate others	City Of Milwaukie	https://www.milwaukieoregon.gov/citymanager/what-neighborhood-district-association
Develop a family emergency plan and accumulate essential supplies	Department of Homeland Security	https://www.ready.gov/make-a-plan
Educate your neighbors and help them with their preparedness	Milwaukie CERT and City of Milwaukie	https://milwaukiepsf.org/cert.html https://www.milwaukieoregon.gov/generalpage/community-emergency-response-team-cert-members
Learn how to get from your home or work to essential services to avoid potential hazards	Department of Homeland Security	https://www.ready.gov/make-a-plan
When choosing a new apartment or home, consider fire, flood, heat waves, trees for shade, and landslides risks	FEMA	https://www.fema.gov/media-library-data/20130726-1904-25045-2423/fema_mitigation_ideas_final_01252013.pdf

Table 29. Natural resources - Organizational actions and resources

Actions to take	Organizational resource	Links to learn more
Evaluate threats to your business from wildfire and smoke, flooding and landslide	FEMA	https://www.fema.gov/media-library-data/20130726-1904-25045-2423/fema_mitigation_ideas_final_01252013.pdf
Prepare a resiliency plan for events to keep people safe, to help their families and to help them get to their families in acute or chronic conditions	Oregon Health Authority	http://www.oregon.gov/oha/PH/HealthYEnvironments/climatechange/Pages/resilience-plan.aspx
Offer programs or education to employees on managing stress and mental health	Oregon Health Authority	http://www.oregon.gov/oha/PEBB/Pages/EAP.aspx

5. Conclusion

Milwaukie's Climate Action Plan is a big, bold roadmap for making real progress on climate change. Working together to implement this plan, our community can be a leader, demonstrating to other cities the power of collective, coordinated action to address this challenge of our generation.

Implementation recommendations

While working to execute the strategies in this plan, the City will also take the following steps to better prepare ourselves for taking action, measuring our progress, and continuing to plan for future conditions:

1. Build City staff and community capacity to ensure effective implementation and equitable outcomes of climate action efforts.
2. Develop City of Milwaukie staff capacity to implement the Climate Action Plan by recruiting and hiring a Climate Action and Sustainability Coordinator
3. Partner with other local and regional governments to influence local, state and federal climate policy activities
4. Facilitate interdepartmental collaboration, engagement, information exchange and peer-to-peer learning related to City of Milwaukie climate action efforts

Plan updates

The City commits to the following steps to ensure our plan remains relevant and timely:

1. Re-evaluate and update the key findings and actions of the Climate Action Plan every four years. The strategies identified to achieve the goals will require periodic reevaluation and updating, taking into consideration advancements in technology, community feedback and financing approaches. New actions will be identified for implementation in the subsequent five years.
2. Update our community greenhouse gas inventory every two years

By developing this Climate Action Plan and by actively committing to implement the plan, Milwaukie is not only responding to the existential threat of climate change, but it will also make our community stronger, healthier, and more economically resilient.

The goals and actions outlined in this plan recognize the need for dynamic participation on all levels. Help us in this effort to reduce our collective greenhouse gas emissions, to educate ourselves, to learn from and teach one another how to be smarter, kinder, and better stakeholders of our planet.

We encourage you to come forward with your ideas to strengthen and inform our efforts to make the City of Milwaukie, **a flourishing city that is entirely equitable, delightfully livable, and completely sustainable.**

Appendices

- A. Acknowledgements and implementation partners**
- B. Glossary**
- C. Building on a foundation: Climate action we have taken thus far**
- D. Superactions from Milwaukie's vision**
- E. Emissions reduction tables**
- F. Progress metrics**
- G. Policy background paper**
- H. Mitigation background paper**